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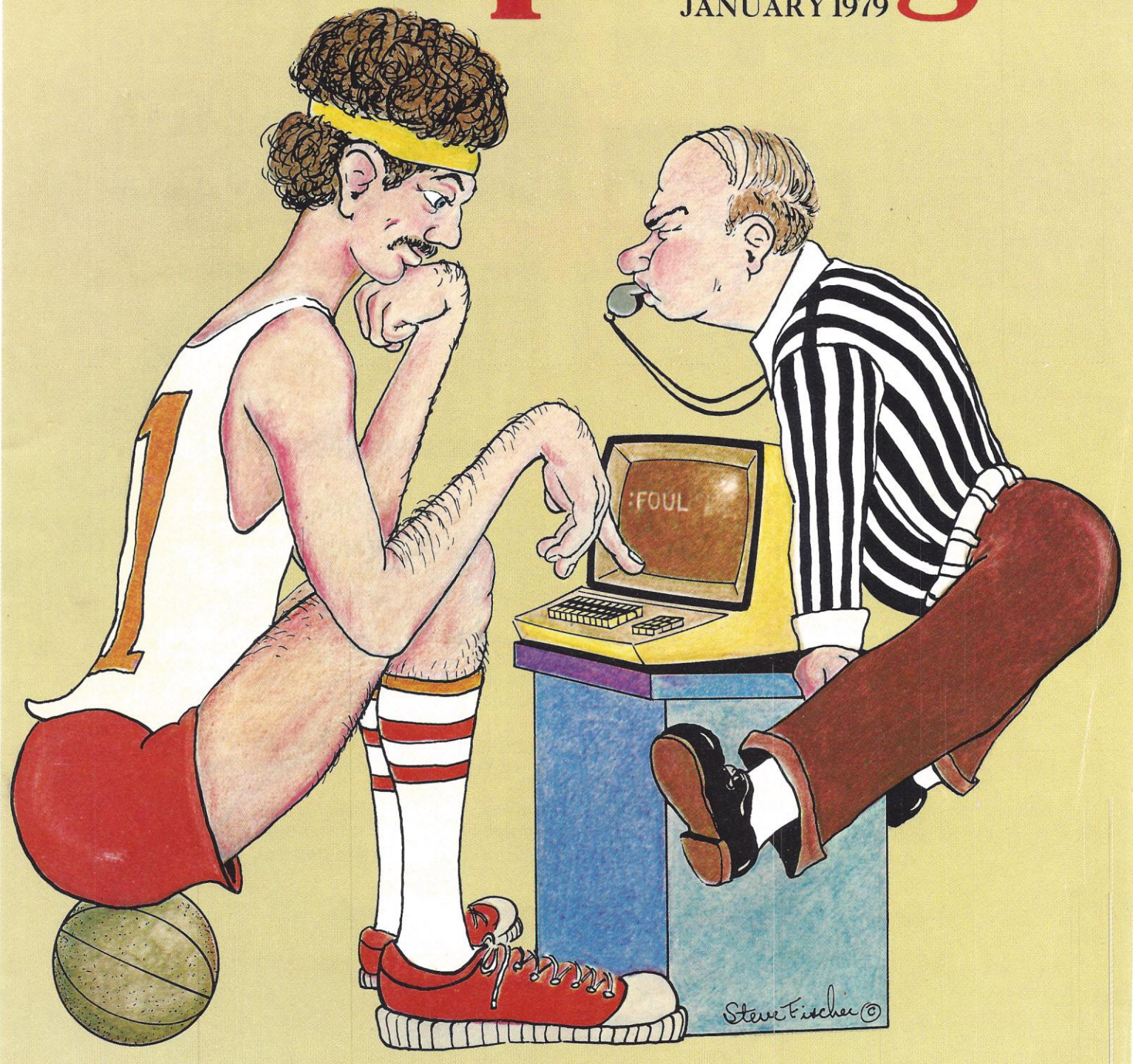
Personal Computing

JANUARY 1979



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Personal Computing

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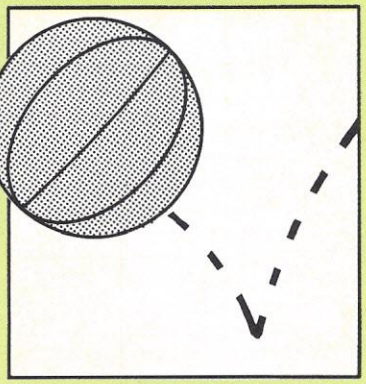

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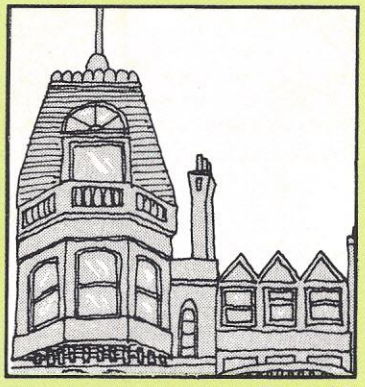

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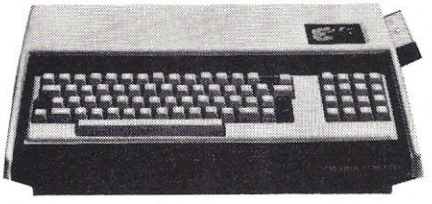

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FEEDBACK

Inventory problems

Dear Sirs:

I enjoyed Ray Vukcevich's article "I'll Put You on Hold and Check" in October's *Personal Computing* and will attempt to adapt it to my TRS-80.

In order to use this program, you must already have an operating inventory program. Please inform me about this inventory program and tell me under what circumstances I may get it.

Leon Bennet-Alder

Author's note: To make full use of the Inventory program you will need a disk drive and a printer for your TRS-80. The program is designed for immediate telephone checks of your inventory. It also prints your complete inventory. You don't really need another program to set up your inventory list. You use the 3 choice on the menu. If you're just getting started with your inventory, you'll have to make a hand list and key the items into the file.

If rapid response time is not a big factor, and you don't have a disk drive for your TRS-80, the program can still be modified for Level II BASIC. But remember: this is an inventory program, not an inventory system. For a complete system you will want to consider programs for shipping, ordering and billing, accounts receivable, reordering and sales information. Data can be routed to all of these areas.

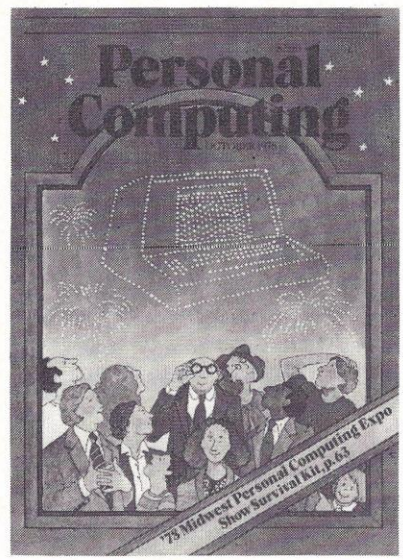
– Ray Vukcevich

Subscriber suggestions

Dear Sir:

I am demonstrating great faith in your magazine by taking out a three-year subscription. You may be interested in my motives, since I do not own a personal computer.

The principal reason is your section on computer chess. I am delighted that



you devote so much space to this topic, and I hope you will expand your coverage in the future, or at least retain its present space. I am also interested in other aspects of artificial intelligence, and in gameplaying by computers. You cannot possibly overdo these subjects, for my taste. I would appreciate your giving sample runs, where appropriate, and complete chess game scores (all the moves, that is) when possible. In the event of tournaments, kindly print the crosstables (showing who defeated whom). Thanks, by the way, for the interesting story on BORIS & CC10.

Another reason is my faith in the personal computing industry. I believe it will grow beyond the dreams of most people. If you are wise, you won't overlook the possibilities of expanding your market to include people who are not microcomputer jocks. I think you would do well to develop a section on financial and investment uses of personal computers. Another possibility (that would interest many teachers) is a regular section on computer simulations of real-life social processes.

Elaborate printouts are fine, and even highly desirable, as long as many of your readers can use the same programming language. The problem is shutting out readers who have invested in less popular systems. Also, don't overlook the programmable calculator market: there are thousands of people out there with HPs and TIs who would be thrilled to see adoptable algorithms for their machines. I know at least a couple dozen people like that, myself.

Ben Crane
Madison, WI

Editor's note: How do you – the readers – feel about Mr. Crane's ideas? Write and let us know. If your letters indicate widespread interest in calculators, programs in languages other than BASIC, artificial intelligence and game-playing, then we'll run more articles on these subjects. *– D.W.*

Another View

Gentlemen:

The letter on page 11 in your September issue entitled "CATV No Big Brother Threat?" is curious. Its author, Mr. Donald Rozak, goes through a lengthy description of the two-way CATV system in The Woodlands, Texas. He tells of a leased-line set-up between a central computer and each subscriber's TV set, in which the computer can turn on subscribers' sets, determine the material to be viewed (by selecting the channel), test the accuracy of the viewer's retention of the material (via opinion polls, voting, etc.) in a two-way communication mode and even monitor the entrances to the subscriber's home. He advises that they are "developing a new generation of equipment that will (provide) home shopping, banking, information retrieval – and other "esoteric services . . ."

This sort of system capability was described by George Orwell (an ex-communist warning us of what they have in mind for us) in *1984.* The computer could prevent purchases if the viewer's political indoctrination scores were not adequate. It could monitor the individual's activities, provide ever-more-closely managed news and information, and do virtually everything Orwell predicted. With such a system installed and de-bugged, the means would be there. All the government

would need would be the pretext to appropriate the system.

The Bible describes a world government (in the Great Tribulation period, before Armaggedon and the Millenium that follows) that requires the people to swear allegiance to Satan's anti-Christ ("the beast") and to receive "the mark of the beast" on their hand or forehead, to qualify them in buying food, getting a job, property transactions, etc. People without "the mark" will be prevented from doing almost anything, including working for a living or purchasing the necessities of life. Such governmental control would be all but impossible without a system like that in The Woodlands.

The Common Market recently completed a gigantic computer installation. Officials there propose assigning everyone in the world a number for electronic banking purposes. They have nicknamed their machine "the beast" and suggest that everyone could have the number assigned by "the beast" tattooed on, so as to provide permanent and positive identification in even the smallest transactions. This system presently lacks the means of communicating with people in their homes.

The system for doing that would be the one in The Woodlands, Texas. Mr. Rozak calls it "at least a partial answer to the nation's energy crisis" – even though, in the last few years, the energy consumed by "transportation" (which he says their system would curtail) in the United States has dropped from 30-some to about 18% of the total. We are now importing almost half our oil, although we have 60 to 80 years' worth in the ground. If it weren't for Washington's manipulative regulation of our gas and oil production rates, well-head prices, pipe-lines, exploration, the stalling on nuclear power and other energy alternatives, there would be no shortage. The shortage we have was artificially created, by an ostensibly "beneficient" government or "Big Brother".

Perhaps Mr. Rozak should answer the question, "In what *way* is the computerized CATV system in The Woodlands, Texas, . . . far from being a *1984*-type nightmare . . . ?"

Peter Malone
Park Ridge, IL

Ideas Needed

Dear Editor and Readers:

I am at work on a book on computers for social-science students and other non-mathematical types who might have occasion to use computers in their work but don't know how to go about it.

I need examples of creative uses of large or small computers in history, political science, economics, psychology, linguistics and other social-science areas. I can't repay you with anything other than a "Thank You" and a mention, but if that's enough, send along your ideas. Thanks!

Roland Parenteau
2007 Turner St.
Richland, WA 99352

Myths, Metaphysics and Computers

Dear Editor:

Your computer myths article in Random Access, August, prompted me to ask, can machines achieve self-awareness? Will a machine ever philosophize on its own – "I think; therefore I am"? Can a machine analyze itself and know that the analysis it is doing is analysis of its own chassis, circuitry or whatever? Please note that I define a machine in this context as a man-made artifice with no organic tissue – living or dead – in its make-up.

I don't believe even chimpanzees believe in their own existance as humans do. This is based on my conviction that there is a metaphysical core in every human being, not found in anything else. This metaphysical core is the home of self-awareness. Do you contend that metaphysics is a realm not restricted to humans and higher (i.e., divine) creatures? Or are you refuting the realm of metaphysics altogether?

In your column, you state that a computer might one day exhibit the property of curiosity. What would motivate it to investigate unknowns "just for the sake of knowing"? Isn't that an emotional behavior? Are you saying computers will one day be emotional? Mr. Spock would be displeased with this!

I hope I have summarized what we mortals are feeling when we say "computers can not. . ."

Bruce Showalter
Abilene, TX

Editor's Note: If you believe an uncrossable gap exists between your mind and an electronic circuit, then you'll never *try* to make a thinking computer. If you believe man was not meant to fly, you'll never soar with the Wright brothers, Lindbergh and Armstrong. If you believe disease is God's punishment for evil, you'll never reap the benefits of Jenner, Pasteur and Salk.

Progress follows an exponential curve. The world a quarter of a century hence will differ more from today than today differs from 1954. And that future world may well include thinking, feeling, self-aware computers; belief in metaphysics will not stop technological advance. You must prepare yourself today to be ready for tomorrow's technology. After all, you'll live the rest of your life in the future. – *D.W.*

Commendation for Compucolor II

Dear Editor:

As beginners in computers, we enjoy your magazine immensely. To help other beginners who often are disillusioned by lack of info, we want to pass on our enthusiastic endorsement of the *Compucolor II* people. They have an excellent product at a good price and their customer service has been unbelievable! It's been many years since we've encountered people in a company who are so helpful and understanding. They really listen and understand problems and suggestions. We received our computer *before* the promised date! They have a Hot Line and we've been helped time and again by both hardware and software people who understand questions the first time and give answers promptly.

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CIRCLE 5

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RANDOM ACCESS

Rx for Pharmacies

As any pharmacist knows, there's more to running a drug store than simply filling prescriptions and monitoring inventory.

A large catalog of state and federal regulations, dealing with everything from pricing policies to maintaining patient profiles, has forced pharmacists to devote more of their valuable time to accounting, legal and administrative matters. To lighten this burden, General Computer Corp. of Macedonia, OH, has developed a complete stand-alone hardware/software package featuring the Honeywell Level 6 minicomputer capable of performing a multitude of pharmacy-related tasks.

Richard Pilarczyk, president of GCC says, "We're so certain that our system will be well-received by the pharmacy community in general that we've already ordered 1000 Model 23 minicomputers worth more than $20 million. Three systems are already up and running, and if the reactions of those using them are any indication, this order represents just the tip of the iceberg."

User enthusiasm for the GCC package stems from its remarkable capabilities. Each system:

- maintains inventory control as well as patient profiles, the latter consisting of complete, up-to-date medical histories on each customer for as long as the law requires.
- monitors drug-to-drug interactions at the ingredient level, even when one of the ingredients is identified only by brand name.
- ranks potential interactions by severity, but leaves final decisions up to the druggist.
- substitutes generic names for brand names to save the patient money.
- "re-fills" existing drug prescriptions at the press of a button.
- indicates whether the purchase of certain drugs is covered by the agency the patient has assigned to pay for them (e.g., state welfare departments ordinarily will not pay for aspirin).
- computes all price extensions by algorithms, a special calculation.
- generates the required number of labels for vials or bottles.
- prepares end-of-year statements by family for tax purposes.
- indicates, where applicable, all special instructions, such as "shake well", "keep refrigerated", etc.
- keeps an audit trail for controlled substances (required by federal regulations).
- creates and maintains hard copy medical charts for use by doctors in nursing homes.

"Obviously a transaction-oriented system with all these capabilities does not sprout up overnight," says Ken McClain, GCC's vice president of marketing. "We were founded in 1969 and we've spent more than eight years designing, developing and refining the entire package, so you can be sure that a great deal of care went into the selection of every element in it — especially the minicomputer."

"The evaluation process that we went through was really an exhaustive one," says Pilarczyk. "At one time or another, we looked at more than 3 vendors and invited 15 or 20 to perform in-house demos. We also visited several manufacturing sites, including those of practically every major supplier of computer hardware."

"Several factors entered into the decision process," says McClain. "We wanted to be sure we could purchase all hardware from a single-source, receive nationwide support from the manufacturer, and acquire reliable, user-oriented equipment that would not require our customers to familiarize themselves with data processing jargon. We also were concerned with the stability and long-term commitment of the vendor, as well as with the degree of hardware/software compatibility in the supplier's minicomputer line."

The 6/23's chosen by GCC feature 64K bytes of memory, 16 megabytes of disk storage, a communications interface and the standard 30-inch "minimount" cabinet. Other hardware in the system includes Honeywell's VIP 7200 display terminals and numerous label printers. The operating system will be the Honeywell GCOS 6 Mod 200

Transaction Processing System and the entire system will sell for around $28,900 — a cost that will be offset by savings in other operators of the pharmacy.

General Computer Corp. hopes to capture large segments of the retail pharmacy market (about 50,000 stores across the country, approximately half of which are members of various chains), the hospital pharmacy market (about 8000 units) and the institutional pharmacy market (about 9000 units, primarily in nursing homes). The company's management team believes that with its recent purchase of the Level 6 minis from Honeywell, it now has precisely the "right combination of ingredients" needed to establish GCC as a leading supplier of automated systems. More information can be obtained from General Computer Corp. at 360 Highland Ave., Macedonia, OH, 44056; (216) 467-0880.

Kitchen calculator

What's a cook do with a recipe written for a number of servings different from the number of people being fed?

He could use M.I.T. Professor Ascher H. Shapiro's recipe-conversion calculator. Dr. Shapiro, Institute Professor and a member of the mechanical engineering department, was granted a patent on a device leading the non-mathematical cook through a series of easy steps to solve the problem.

The kitchen calculator is expected to find wide use in household cooking as well as in institutional and restaurant food preparation. No mathetical knowledge is required to use the calculator.

The calculator is about the size of a paperback book. To save countertop space, the calculator can also be hung vertically on the wall using a mounting bracket.

Color-coded instructions printed on its face lead the cook through all the numbered steps. First the cook punches in the number of servings desired, then the number of servings specified in the recipe. Third, the user punches in the quantity and units of measure of an ingredient, as printed in the recipe. Fourth and last, the key representing the units desired is punched, and the readout display shows the quantity of that ingredient. Steps three and four are repeated for each ingredient.

In addition to allowing cooks

to easily scale recipes up or down with respect to servings, the calculator also makes it easy to switch foreign units of measure into familiar units — for example, cubic centimeters to tablespoons, or liters to cups. It will also ease the problem cooks face when a recipe calls for, say, a quart and the only measuring utensil handy is a cup.

Professor Shapiro, who occasionally cooks, said the invention was inspired by a friend who teaches restaurant management. "My friend mentioned how difficult it was to convert recipes from a given quantity to the required quantity and it occured to me it would be possible to invent a calculator to help people who don't have a working knowledge of mathematics or of conversion factors."

Newsletter Notes

The information explosion in the computer field has scattered the market with newsletters and magazines providing aid, advice and entertainment for hobbyists and business persons.

The Software Exchange of California has announced a few price changes since their inception several months ago. The Exchange still provides reviews and articles on microcomputer software, along with classified advertising space. This bi-monthly magazine is now available at computer stores for $1 per issue, and by subscription for $5 per year. Add $4 for air mail service to Canada or Mexico. Foreign subscriptions are $19. For more information contact The Software Exchange, Box 55056, Valencia, CA 91355.

TRS-80 Club of Arlington, MA, is preparing a free semi-annual newsletter. Send SASE for subscription. The club will accept limited TRS-80 related advertising. Space is sold by half page for $50 and full page for $85. Write to TRS-80 newsletter, 96 Dothan St., Arlington, MA 02174.

Robotics Newsletter is a monthly publication for both amateur and professional robot enthusiasts, presenting articles on microcomputers, batteries, motors, automata theory, sensory devices and robot history. Yearly subscriptions are $8.00 in the US and Canada. For information contact International Institute of Robotics, Box 615, Pelahatchie, MS 39145.

The TRS-80 Monthly Newsletter, published by H&E Computronics Inc. provides exchange information related to the care, use and application of TRS-80 Computer Systems. The Newsletter publishes articles and programs written by its readers. Comments, questions and suggestions are encouraged.

Subscriptions are $24 per year

($36 outside of the United States and Canada — Air Mail). Back issues are available at $2 each. For more information contact Mathematical Applications Service, Box 149, New City, NY 10956; (914) 425-1535.

DUMP, a monthly periodical for TRS-80 users, incorporates news and information and runs software ready to load from a 33-1/3 RPM DUMP Disk record.

The DUMP Disk loads into the TRS-80 system with the use of an ordinary phonograph, a software medium developed to provide a permanent and efficient program storage method.

Each issue contains programs on finance, education, or even games. Programs are provided with complete documentation and line editing information for Level I and Level II BASICs.

A one-year subscription costs $20. For more information, contact DUMP Publications, P.O. Box 2454, Jacksonville, FL 32203; (800) 874-4500.

INFO 3, publisher of self-study computer training courses, offers free copies of their RPG II programming standards. The standards are taken from the publisher's *RPG II Learning Series,* a set of learner-paced audio-cassette courses that range from introductory to advanced RPG II programming concepts.

The document includes a basic policy statement on standards, as well as standards for documentation, indicator usage, program ID, control cards, coding conventions for all spec types and a standardized first-page coding sheet for placing identifying comments at the beginning of a program.

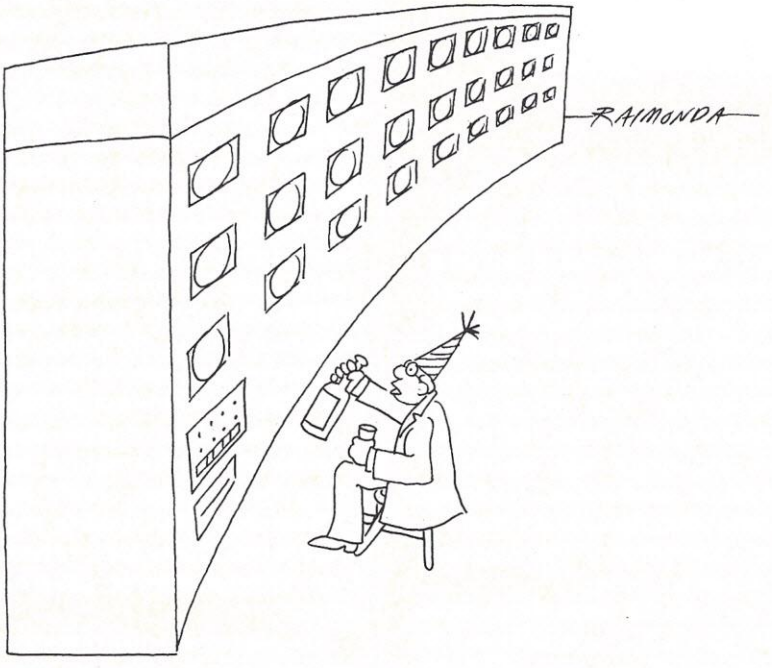
Free copies of the RPG II programming standards can be obtained from INFO 3, 21241 Ventura Blvd., Suite 193, Woodland Hills, CA 91364; (800) 423-5205 or (213) 999-5753.

Reviews of over 125 articles from dozens of computer and communications trade publications are now available each month in *Computer Business,* a newsletter from Contemporary Communications, Inc.

According to officials, the newsletter helps executives, professionals and librarians in these fields keep up to date with their areas of interest.

Each review contains the title of the article, a brief abstract, the source of the article and a "Reader's Key" denoting length, orientation and readability.

Annual subscriptions cost $48 in North America, $60 elsewhere. A three-month trial subscription is $12 (prepaid only). For further information or a free sample copy, contact Contemporary Communications, Inc., 2909 Oregon Court, Suite C-11, Torrance, CA 90503; (213) 320-6599.



"HAPPY NEW YEAR."

NCC '79 Update

"Personal Computers in Other Hobbies", a session at NCC'79, will be chaired by *Personal Computing* editor and publisher Harold G. Buchbinder. The session will deal with combining personal computing with other hobbies such as chess, model rocketry, audio, gambling and model railroading. Persons interested in speaking at the session should contact H.G. Buchbinder at *Personal Computing,* 1050 Commonwealth Ave., Boston, MA 02215; (617) 232-5470.

NCC'79 will run June 4 to 7 in the New York Coliseum.

The NCC technical program will consist of over 100 sessions emphasizing management, applications, science and technology, and social implications.

According to NCC Chairman Merlin G. Smith, the program "will highlight recent developments in computer science and technology and will provide individuals with a better understanding of the total industry, including a greater consciousness of the social implication of the expanding use of computers."

The Personal Computing Festival, held at the Americana Hotel, will feature technical program sessions, application demonstrations and commercial exhibits.

For more information contact NCC '79, c/o American Federation of Information Processing Societies Inc., 210 Summit Ave., Montvale, NJ 07645.

Cotton Pickin' Good

Mechanical pickers took the backache out of cotton picking and now a microcomputer system is taking the sweat out of cotton gin office operations.

The system called Cot-Stem cuts administrative costs of gin operations by increasing office personnel efficiency and reducing the number of forms required, reports Darryl Goebel, developer of the system and president of the Altair Computer Center of Phoenix, AZ.

Over-all, said Goebel, office costs can be cut from nearly $1 per bale when the work is done manually to 20 or 25 cents (or less) with the new computer system.

The Cot-Stem system comes in three configurations, ranging in price from $10,000 to $25,000, varying with the size of the gin and the size of the computer's storage. The basic system is geared to gins that process about 5000 bales a year, while a larger system can handle organizations that process upwards of 100,000 bales annually.

The system consists of a MITS microcomputer, a video display terminal with keyboard, a 180 characters-per-second printer, complete dust and electrical protection and software to operate the system. Clerks can be trained to operate Cot-Stem in less than three days, notes Goebel, and while every gin has a different accounting system, the programs are being adapted to each operation.

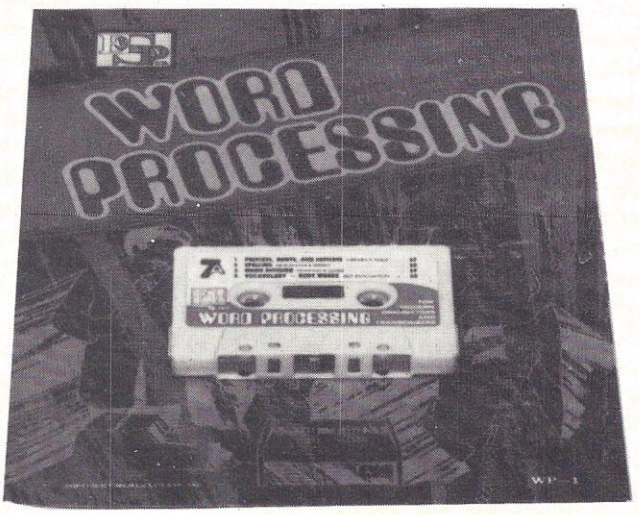
The cotton ginning season lasts four to six months with people working 24 hours a day, seven days a week. Office record keeping for the previous day's ginning must be accomplished with office personnel who work 8 to 10 hours each day. Much of this work is repetitious and time-consuming. Frequent interruptions in paperwork occur when growers need information or bring in their harvest for weighing.

Cot-Stem follows cotton processing from field to buyers. It enters into cotton ginning operations from the point at which cotton goes into trailers, ricks or modules. The system totes up ginning charges for growers, both for separating lint and trash from cotton seeds and for crediting the grower for the seed obtained. Daily gin statements report how much cotton has been ginned, how much is pure lint and how many bales are involved. The system also prints such reports as insurance forms, shipping documentation and marketing statistics after the bales are produced.

Also included is government classification information detailing grade (quality), staple (length of fibers) and micronaire (how mature the fibers are), returned from samples sent to government offices.

Six pieces of information are entered into the system: grower identification of the cotton, the field it was produced from, the weights of the load, the bales pro-

Word Processing Course



Atlanta Lanier Business Products has announced a new word processing course covering material useful for an executive with emphasis on word processing transcription skills.

The course package is composed of 24 major units on 12 standard cassettes, which include 72 assignments with documents and 24 self-evaluation exercises. The self-evaluation sections introduce the learner to typical questions and problems associated with word processing and secretarial practice including vocabulary, grammar and general office skills.

The package contains a 120-page workbook structured to guide the learner through the course without additional material.

Designed for flexibility, the course can be instructor administered or student controlled or a combination of both. Appropriate sections can be taught independently of others according to the proficiency and requirements of the learner. The course is applicable in many areas including junior and senior high schools, colleges or universities, trade and business schools, private businesses, government agencies and individual training.

Price is $139, with extra workbooks $5 each. For additional information call toll-free (800) 241-1706; or contact Lanier Business Products, 1700 Chantilly Drive, N.E., Atlanta, GA 30324.

duced from each load and their weights, the government classing information and shipping information. This basic information is keypunched into the system from scale receipts and other documentation. Output includes shipping papers, receipts, marketing data, insurance reports, the amount of cotton in the gin's yard, bid sheets for cotton buyers and all other daily and seasonal reports.

The final task of the system is producing a total recapitulation for growers, ranking their fields by productivity per acre. The growers plant different varieties of cotton in as many as 90 fields. The computer system draws a simple graph that shows the grade/staple combination.

Help wanted–computer found

HELP WANTED — Distributor of fund-raising carnival supplies seeks employee to update, sort and print 40,000-name mailing list; handle accounts payable bookeeping; keep track of inventory; and, whenever called on, to print shipping labels, type error-free letters, prepare charts and figure bingo odds. Will be expected to take on accounts receivable and payroll bookkeeping in future. SALARY: One-time payment only, under $12,000. No salary to be paid thereafter.

S. Lachman & Sons in College Park, MD, didn't actually run this ad — but if it had, the MITS/Altair microcomputer system it acquired would have filled the position perfectly.

Gary Cooper, vice president of this fourth-generation family-owned business, explains, "We were buying mailing lists from outside suppliers and doing everything manually. This was very unsatisfactory. The lists we bought were never updated properly and contained many obsolete names and addresses. And with over 40,000 names to keep track of, handling the job manually was terribly inefficient.

"I looked at probably every system in the minicomputer and microcomputer class," Cooper recalls. "MITS/Altair offered a full system that was working and dependable. And no other system had comparable software." Total system cost — including two disk drives with extensive floppy disk storage capacity, video display terminal and printer — was in the $10,000 to $12,000 range.

Lachman supplies materials used in fund-raising events (carnivals, fairs and parties) put on by schools, churches, fire departments and service clubs. Product lines include everything from bingo supplies, roulette wheels and blackjack tables to New Year's hats and horns. But Lachman only supplies these items to charitable, civic and religious organizations, not to professional gamblers.

In its mailing list application, the system updates and corrects names and addresses, sorts the names into any desired sequence or category and prints out pressure-sensitive mailing labels.

"Now all we have to do is input the names once at the computer terminal and from that point on it's very simple to write a little program to sort them into any kind of classification we want," says Cooper, "whether it's alphabetically, by zip code, by type of business or whatever.

"If I want to sort through my 40,000 names and mail only to fire departments in Delaware, the computer can do that. And if I want to compound that with fire departments in Virginia and West Virginia, all I have to do is put in each of those three diskettes for a couple of minutes, and next thing I know the machine has sorted together a brand-new list of fire departments in those three states. I tell the computer to 'sort it', and they're all in zip code order; then I tell it to 'print it' and I've got the labels for a new list, customized for whatever marketing I want to do.

"I get about 2000 names on each diskette — about 0.5 cents per name for storage. That's as cheap as keeping the names on labels, and we can use each name an unlimited number of times and re-sort the names in unlimited different ways."

Lachman's MITS/Altair computer also handles the company's accounts payable, replacing a large mechanical bookkeeping machine previously used for this purpose.

"Our computer makes posting a lot faster and doesn't have the maintenance problems of the mechanical system," Cooper says. "All you need to do is key in an account number and it automatically searches the files, gets the account, finds its past balance, asks you the pertinent questions and does all the posting. And when it's all finished, it gives you a hard copy.

"Our accountant doesn't have to handle ledger cards any more. Any comparisons she needs to make, the computer can do for her. Previously she did it by hand or on an adding machine. Reducing the number of hand entries reduces the number of mistakes and gives a much neater, cleaner finished product."

A third major task performed by Lachman's microcomputer is inventory control. "While we don't keep a computerized perpetual inventory on all of our 10,000 different items — many of which cost less than a penny apiece — we do use the computer to keep track of certain staple, frequently-used items," Cooper explains. "It keeps the records of what we purchase and sell so that we can make monthly comparisons and order more efficiently in the future."

Along with these major applications, the microcomputer also prints shipping labels, prints charts, automatically types letters via a word processing program and calculates odds for customers using bingo and other games of chance for fund-raising purposes.

Future plans for the computer

include adding payroll for the 15-employee firm, as well as accounts receivable. "In the accounts receivable system, we plan to keep all the current accounts on-line so that the computer will be used for real-time inquiry to the data base as well as posting invoices," he points out.

"I plan to put several on-line terminals in our front office and our billing clerks and other personnel will be able to call up any account by number, see the balance, whether it's past due, how much the customer has purchased in the past and so on. An advanced time-sharing version of BASIC will allow several terminals to access the system concurrently without interfering with each other.

"The small businessman no longer has to decide, 'Do I do it by hand or spend $50,000 for a computer?' " Cooper adds. "For the cost of a bookkeeper for one year, he can pay for the whole system. Here at Lachman I can probably save one-half to one person every year because of the system. So it pays for itself in one to two years in labor savings alone.

Micro stars at TV network

As Starsky and Hutch close in on this week's villain, a large computer system is helping to decide how loud the music will rise and when we will fade into a commercial. And, this large computer may be getting some of its instructions from a tiny desk-top computer in Emil Rich's laundry room.

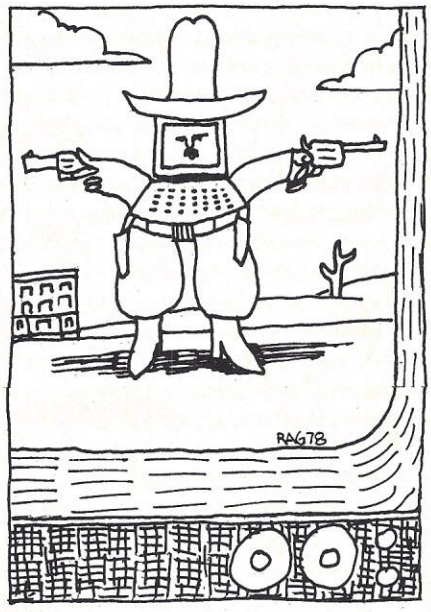
Rich, an Emmy Award winning editor who is Engineering Supervisor for the Videotape Department at ABC Television in Hollywood, helps manage four large computers used for editing shows. He writes modifications to many of the programs for these giant computer systems on his home computer.

"Three years ago, I became aware that the computer was arriving at work," Rich explained. "ABC had been using an electronic editor but the range of possible audio-visual effects you now see on television was limited. Fancy effects like dissolves, keys and wipes were impossible. With the new computerized editing systems, an editor is now able to enter instructions for any desired effects into the computer.

"I had read of the advent of small computers that could be purchased for about $1000 and decided that this would be the best way to prepare for the computerization of my department."

Rich purchased a MITS 8800 microcomputer and peripheral equipment. MITS products are manufactured and marketed by Pertec Computer Corporation's Microsystems Division, Chatsworth, CA.

He took on the task of teaching himself to operate the computer so that he could apply that knowledge at ABC. He keeps his system in the half of his laundry that doubles as his office at home.



"It took me about nine months to get the system running efficiently but it was worth every second and every penny," he continued. "I had the MITS BASIC manual, bought several other books and asked a lot of questions."

Rich has also added to his system, tacking on additional memory, a powerful disk operating system, a dual disk drive system, serial interface, a parallel port, an intelligent video terminal and a teletype. He has invested about $3500 in the system to date.

"Now I test programs at home for the computerized systems at work. With 122 people on the staff and over 30 machines constantly running, it is hard to stop and think. I may get an idea on my way home, start up my MITS system when I get there and create a program.

"We don't intend to limit the use of the large computers strictly to broadcast editing," said Rich. "I am using the MITS system more and more to create programs for personnel and facilities scheduling, as well as experimenting with a program where the computer will tell me how I can get the best time and utilization out of the employees and equipment in the department.

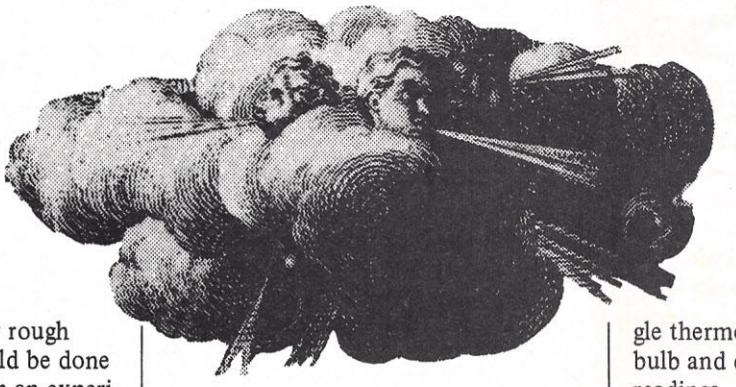
The station's biggest project will be tying all of the on-air machines in the department to the computers. There are 34 on-air machines, ranging from ones that put on the shows to those that run commercials and station breaks. These are responsible for getting shows on the air at the exact time.

"This creates a tremendous amount of pressure for the operators because they can't be even a second off," Rich explained. "If my MITS system and I have it our way, all of the machines will be run by computers so that the operator will supervise, but the computer will do all the work.

"We are also talking about putting terminals into many departments at ABC. We would have a central computer in the Videotape Department but other departments could draw upon it in a timesharing mode. Our maintenance department wants to use it for parts inventory, which may entail $500,000 worth of parts.

A Program for All Seasons

WEATHERMAN



BY GLENN PRESCOTT

After surviving a particularly rough winter, I pondered what could be done to assure never suffering such an experience again. A thorough examination of all alternatives (none of which I could afford) led me to accept my fate and indulge in a bit of self-therapy by writing a program, appropriately named *Weatherman*. *Weatherman* will not cure your bad weather blues, but it will prove interesting and useful to weather buffs and to those of us who feel a need to quantify the comfort or misery we experience during climate extremes.

The program consists of four separate parts:

Temperature Conversion – Converts a given temperature to three other temperature scales.

Temperature Humidity Index – Provides a numerical measure of comfort during warm seasons.

Wind Chill Equivalent Temperature – Indicates the cooling effect of the wind during cold seasons.

Relative Humidity and Dew Point Temperature – Derives these parameters from temperature measurements.

Gathering data for this program requires a quality mercury thermometer. Also desirable, but not necessary, is a barometer and a psychrometer. A psychrometer is two mercury thermometers mounted on a common support (see Figure 1). The support is connected to a handle so the entire instrument can spin freely in the air. One of the thermometers has a thin layer of muslin, silk, cotton or other loosely woven fabric wrapped around the bulb, which is kept wet when the instrument is in use. This is therefore called the "wet bulb" thermometer and the other the "dry bulb" thermometer.

The dry bulb thermometer shows the current air temperature. The wet bulb thermometer indicates humidity in the surrounding air. As the moisture in the fabric on the wet bulb thermometer evaporates, the wet bulb thermometer's temperature falls. The faster the rate of evaporation, the lower the wet bulb thermometer reading falls below the dry bulb reading. The rate of evaporation depends upon the relative humidity (the amount of water present in the surrounding air). Hence the difference in temperature between the wet bulb and dry bulb thermometers depends upon the relative humidity. The wet bulb temperature represents the lowest temperature to which the skin can be cooled by evaporation of perspiration.

To insure proper evaporation from the wet bulb thermometer, the air surrounding it should be continuously replaced; otherwise evaporation slows down as the stagnant air surrounding the wet bulb becomes saturated. Therefore, you should whirl the psychrometer rapidly, stopping every minute or so to check the wet bulb temperature, until obtaining the lowest wet bulb temperature. The velocity of air passing the psychrometer while whirling should be about 12 feet per second. Faster velocities offer no significant improvement.

You can buy a psychrometer from most scientific supply companies, such as Edmund Scientific Company (Barrington, NJ 08007). If you want to take the least expensive route, you can construct your own, or even use a single thermometer to take separate wet bulb and dry bulb temperature readings.

Temperature Conversion

To run the first portion of the program, enter a temperature in Fahrenheit, Celsius, Kelvin or Rankine; the program converts this temperature to the other three scales (see Sample Runs). Most of us recognize the Fahrenheit and Celsius scales. Fahrenheit, the standard scale for engineering and medical practice in the United States and England, is used in everyday life in these countries. Celsius, primarily used in scientific work, is rapidly gaining acceptance in this country for general use.

The Kelvin and Rankine scales are based on fundamental laws of thermodynamics. Widely accepted as the universal "absolute" temperature scale, the Kelvin scale measures the degree of thermal molecular motion within any substance. At absolute zero all molecular motion ceases. The Rankine scale is used in some engineering work, particularly for the calculation of theoretical efficiency of engines.

Temperature Humidity Index

The Temperature Humidity Index (THI) measures the degree of comfort (or discomfort) experienced by most people during the summer. Developed by the U.S. Weather Bureau, THI is far more useful for estimating bodily comfort than either temperature or humidity alone. Since THI depends upon air temperature and humidity, this portion of the program requires wet bulb and dry bulb temperatures as inputs (see Sample Runs).

Not a temperature in the usual sense, THI describes a sensation. Experimental studies show that most people are comfortable when THI equals 70 or

less. About half the population are comfortable when THI equals 75. By the time THI reaches 80 most persons are uncomfortable. At THI values above 80, heat exhaustion becomes a problem. Remember, THI is a warm weather indicator. Values far below 70 have no significance. Note that THI may remain comfortably low even on hot days, provided the air is dry.

Air conditioning engineers use a daily average THI to determine the amount of cooling power needed when designing equipment. An air conditioner that can maintain a temperature of 75°F (24°C) and a relative humidity of 50% is also maintaining a THI of 70, which is comfortable for almost everyone. Also, electric power companies can estimate the amount of power needed for air conditioning in a given period from expected values of THI.

Wind Chill Equivalent Temperature

On warm days, human comfort depends upon temperature and relative humidity. However, on cold days relative humidity has a less significant effect, especially outdoors, where wind speed becomes a major factor. Outdoors, the wind chill equivalent temperature becomes useful. Developed during the early Arctic explorations, the concept of wind chill equivalent temperature has become a winter standard in the country's cold areas.

The coldness you feel is related to the loss of heat from exposed flesh. The *Weatherman* program indicates the wind's and temperature's cooling power through convection cooling (direct loss of body heat to the atmosphere) of the skin, which is the major source of body heat loss in cold weather.

Weatherman uses a standard wind speed of 4 miles per hour as the comparison point, roughly the wind speed generated by someone walking briskly under calm conditions. Also, 4 mph is the generally accepted wind speed for calculating wind chill equivalent temperature. The only inputs required for this portion of the program are dry bulb temperature and wind speed in miles per hour (see Sample Runs). The formula employed in this routine is the basis for the popular wind chill equivalent temperature chart published by the U.S. Weather Bureau.

Relative Humidity and Dew Point Temperature

Relative humidity is the ratio, in percent, of the moisture actually in the air to the moisture the air would hold if it

Sample Runs

```
SELECT THE PORTION OF THE PROGRAM YOU WANT:
     1. TEMPERATURE CONVERSION
     2. TEMPERATURE HUMIDITY INDEX
     3. WIND CHILL EQUIVALENT TEMPERATURE
     4. RELATIVE HUMIDITY AND DEW POINT

ENTER YOUR SELECTION--
?1


     ** TEMPERATURE CONVERSION **

INPUT TEMPERATURE AND SCALE SEPARATED BY A COMMA.
LET   C=CELSIUS
      F=FAHRENHEIT
      K=KELVIN
      R=RANKINE
FOR EXAMPLE: 30,C OR 45,F

ENTER TEMPERATURE,SCALE--
?75,F
        23.88889 DEGREES CELSIUS
        75 DEGREES FAHRENHEIT
        297.0389 DEGREES KELVIN
       534.67 DEGREES RANKINE

TRY AGAIN? (Y OR N)
```

```
     ** TEMPERATURE HUMIDITY INDEX **

INPUT DRY BULB,WET BULB TEMPS IN FAHRENHEIT DEGREES--
ENTER T(D),T(W)
?86,80

THI= 81.4 (BEWARE HEAT EXHAUSTION)

TRY AGAIN? (Y OR N)
```

```
     ** WIND CHILL EQUIVALENT TEMP **

INPUT TEMP IN FAHRENHEIT, AND WIND VELOCITY IN MPH
?10,20

EQUIVALENT WIND CHILL TEMP= -24.639 DEGREES

TRY AGAIN? (Y OR N)
```

```
    ** RELATIVE HUMIDITY & DEW POINT **

INPUT DRY BULB,WET BULB TEMPS IN FAHRENHEIT DEGREES
ENTER T(D),T(W)
?86,80

USE STANDARD ATM PRESSURE? (Y OR N)
?Y


        T(DRY)=   86
        T(WET)=   80
   T(DEW POINT)=   78
   REL HUMIDITY=   76.96757

TRY AGAIN? (Y OR N)
?N
```

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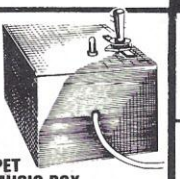

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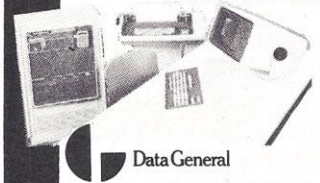

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Program Listing

```
5 REM PROGRAM NAME: WEATHERMAN
10 REM WRITTEN BY GLENN PRESCOTT
15 PRINT "        **** WEATHERMAN ****"
20 PRINT\PRINT
25 PRINT "SELECT THE PORTION OF THE PROGRAM YOU WANT:"
30 PRINT "     1. TEMPERATURE CONVERSION"
35 PRINT "     2. TEMPERATURE HUMIDITY INDEX"
40 PRINT "     3. WIND CHILL EQUIVALENT TEMPERATURE"
45 PRINT "     4. RELATIVE HUMIDITY AND DEW POINT"
50 PRINT\PRINT "ENTER YOUR SELECTION--"
55 INPUT S
60 PRINT\PRINT
65 ON S GOTO 70,235,300,355
70 PRINT "     ** TEMPERATURE CONVERSION **"\PRINT
75 PRINT "INPUT TEMPERATURE AND SCALE SEPARATED BY A COMMA."
80 PRINT "LET   C=CELSIUS"
85 PRINT "      F=FAHRENHEIT"
90 PRINT "      K=KELVIN"
95 PRINT "      R=RANKINE"
100 PRINT "FOR EXAMPLE: 30,C OR 45,F"
105 PRINT\PRINT "ENTER TEMPERATURE,SCALE--"
110 INPUT T,S$
115 IF S$<>"C" GOTO 140
120 T1=T
125 T2=(9/5)*T+32
130 T3=T+273.15
135 T4=(9/5)*T3\GOTO 205
140 IF S$<>"F" GOTO 160
145 T2=T
150 T1=(5/9)*(T-32)
155 T=T1\GOTO 130
160 IF S$<>"K" GOTO 185
165 T3=T
170 T4=(9/5)*T
175 T2=T4-459.67
180 T1=(5/9)*(T2-32)\GOTO 205
185 IF S$<>"R" GOTO 200
190 T3=(5/9)*T
195 T4=T\GOTO 175
200 PRINT "INPUT ERROR, TRY AGAIN--"\ GOTO 75
205 PRINT "     ";T1;"DEGREES CELSIUS"
210 PRINT "     ";T2;"DEGREES FAHRENHEIT"
215 PRINT "     ";T3;"DEGREES KELVIN"
220 PRINT "     ";T4;"DEGREES RANKINE"\PRINT
225 PRINT "TRY AGAIN? (Y OR N)"\INPUT A$
230 IF A$="Y" GOTO 105\GOTO 595
235 PRINT "     ** TEMPERATURE HUMIDITY INDEX **"\PRINT
240 PRINT "INPUT DRY BULB,WET BULB TEMPS IN FAHRENHEIT
      DEGREES--"
245 PRINT "ENTER T(D),T(W)"
250 INPUT D,W
265 C=0.4*(D+W)+15\PRINT
270 PRINT "THI=";C;
272 IF C>=60 GOTO 275
273 PRINT "(BELOW COMFORT REGION)"\GOTO 290
275 IF C>70 GOTO 280\PRINT "(IN COMFORT REGION)"\GOTO 290
280 IF C>=80 GOTO 285\PRINT "(MARGINAL COMFORT REGION)"\GOTO 290
285 PRINT "(UNCOMFORTABLE REGION - BEWARE HEAT EXHAUSTION)"
290 PRINT\PRINT "TRY AGAIN? (Y OR N)"\INPUT A$
295 IF A$="Y" GOTO 245\GOTO 595
300 PRINT "     ** WIND CHILL EQUIVALENT TEMP **"
305 PRINT
310 PRINT "INPUT TEMP IN FAHRENHEIT DEGREES, AND WIND VELOCITY
      IN MPH"
315 INPUT D,U
320 U9=U/2.23694
325 D9=5/9*(D-32)
330 Q=33-(10.45+10*SQR(U9)-U9)*(33-D9)/22.034
335 Q=9/5*Q+32\PRINT
340 PRINT "EQUIVALENT WIND CHILL TEMP=";Q;"DEGREES"\PRINT
345 PRINT "TRY AGAIN? (Y OR N)"\INPUT A$
350 IF A$="Y" GOTO 310\GOTO 595
355 PRINT "   ** RELATIVE HUMIDITY & DEW POINT **"
356 PRINT
360 PRINT "INPUT DRY BULB,WET BULB TEMPS IN FAHRENHEIT
      DEGREES"
365 PRINT "ENTER T(D),T(W)"
370 INPUT DI,WI\PRINT
375 PRINT "USE STANDARD ATM PRESSURE? (Y OR N)"
376 INPUT A$
380 IF A$="Y" GOTO 390
385 PRINT "ENTER ATM PRESSURE, SCALE (M=MILLIBARS,
      I=INCHES OF MERCURY)"
386 INPUT A,H$
387 IF H$="M" GOTO 395
388 A=A/0.750062\GOTO 395
390 A=1013.26
395 S=373.16
400 I=273.16
405 T=DI
410 GOSUB 525
415 D2=T2
420 E1=E
425 T=WI
430 GOSUB 525
435 W2=T2
440 E2=E
445 E3=A*(D2-W2)*(.00066*(1+.00115*W2))
450 H=100*(E2-E3)/E1
455 P=E2-E3
460 T=DI
465 GOSUB 525
470 IF E=P GOTO 490
475 T=T-0.1
480 GOSUB 525
485 IF E>P GOTO 475
490 N9=INT(T)\N5=T-N9
491 IF N5>=0.5 GOTO 493
492 T=N9\GOTO 494
493 T=INT(T+0.5)
494 PRINT\PRINT
495 PRINT "          T(DRY)=";DI
500 PRINT "          T(WET)=";WI
505 PRINT "   T(DEW POINT)=";T
510 PRINT "   REL HUMIDITY=";H\PRINT
515 PRINT "TRY AGAIN? (Y OR N)"\INPUT A$
520 IF A$="Y" GOTO 356\GOTO 595
525 T2=5/9*(T-32)\ T3=T2+273.15
530 IF T<=32 GOTO 565
535 V=-7.90298*(S/T3-1)
540 W=5.02808*CLG(S/T3)
545 X=-.000000013816*(10^(11.344*(1-T3/S))-1)
550 Y=.0081328*(10^(-3.49149*(S/T3-1))-1)
555 E9=V+W+X+Y+3.0057209
560 E=10^(E9)\RETURN
565 V=-9.09718*(I/T3-1)
570 W=-3.56654*CLG(I/T3)
575 X=.876793*(1-T3/I)
580 E9=V+W+X+.785835
585 E=10^(E9)
590 RETURN
595 PRINT "NEW SELECTION? (Y OR N)"\INPUT A$
600 IF A$="Y" GOTO 20
605 END
```

were saturated at the same temperature and pressure. Relative humidity is a useful index of dryness or dampness for determining the air's capacity to accept moisture. The lower the relative humidity, the more easily air absorbs moisture. When the air is saturated, the wet bulb and dry bulb temperatures will be equal and the air can accept no more moisture.

We often associate low relative humidity in the summertime with comfort, and high relative humidity with discomfort. In the winter this is not so. Low relative humidity is common during cold weather because cold air holds less moisture. This drier air can cause dryness of skin or throat and add to the discomfort of respiratory infections. The term "indoor relative humidity" specifies the relative humidity outside air will have when heated without the addition of moisture. It always has a low value in cold weather and better measures the drying effect on skin than does outdoor relative humidity.

At the dew point temperature, water vapor in the atmosphere begins to condense as fog or dew. If the air temperature drops to the dew point temperature with no change in atmospheric pressure, the air will become saturated and the wet bulb temperature will equal the dry bulb temperature.

This portion of the program requires wet bulb temperature, dry bulb temperature and barometric pressure as inputs (see Sample Runs). You may choose the "standard" atmospheric pressure as the basis for calculation, or enter the actual barometric pressure in either millibars or inches of mercury. Assuming the standard atmospheric pressure obtains fairly accurate results. Amateur meteorologists who require greater precision might prefer to use actual barometric pressure.

Weatherman is a program for both the curious observer and the serious amateur meteorologist. The formulas it employs are accepted standards. No short cuts or simplifications are used.

The program employs a backward slash (\) to make multiple statements within a single line. Many versions of BASIC use the colon (:) for this function. The special function CLG in line 540 is the common logarithm (base 10); many versions of BASIC use LOG for this function. □

THE DIODE CONNECTION

BY HENRY BRAINERD

"Hey, Lank! Remember vacuum tubes?"

"Sure do. You'd have to be a kid not to remember them. All the early computers used them – Eniac, Whirlwind, Univac, IBM 650 and 700 series – don't remember how many more."

We were on the elevator at 1050 Commonwealth Avenue after a conference at Personal Computing. The elevator door slid open and Lank banged his head on the doorway as we stepped out. Being six foot six he usually gets whacked around at every doorway.

"Let's get some coffee," he said, rubbing the new lump on his forehead. "There's a lunch counter a few doors down from here."

"Let's see," I mused, as we headed for the eaterie. "Vacuum tubes are about as old as I am. DeForest invented them in 1907 – a few months before I was born."

"Beat you there, Hank. I'm a year older'n you, so I guess I'm older than vacuum tubes too. But in a way they're somewhat older than that. Before 1900, Thomas Edison discovered that a hot filament in a vacuum gave off a negative charge in a cloud of electrons. But he was strictly a practical man. Couldn't see any way to use it so he dropped the idea. Then in the early 1900's an Englishman named Fleming inserted a piece of sheet metal into a bulb with the filament. He called it a 'plate'. Electrons that left the hot filament were attracted to the plate, but none could go the other way. This was called a 'Fleming Valve' at the time. We call it a diode today. It made a good detector for radio waves – called 'wireless' waves then."

"Yeah, I remember. A wireless transmitter was a spark gap that fired a few hundred times a second. Each spark started a strain of damped oscillations in a tuned circuit. They were fed to an antenna and a ground. At the receiver you had to 'detect' the signal, that is to say, 'rectify' it. Then you'd hear a rough buzz in your headphones, like sawing a tin can."

"Right, Hank. And the operator at the transmitter would key it in the famous dits and dahs of Morse code."

We sauntered into the lunch counter and we both ordered coffee, black, no sugar. "Speaking of dits and dahs," I joshed, "remember 'She was only the telegrapher's daughter but she dit-dit, di-dit, did it, with dah-dah'." I sat back to watch Lank's expression at this gem of a limerick.

"Around 1917 the Navy perfected radio telephony and managed a two-way conversation between Washington and Honolulu."

He wrapped his legs around the stool. "Foureyes! That's as bad as 'Carry your bag, sir?' 'No thanks, I'll let her walk.' Anyhow, getting back to DeForest, if you stop interruptin' with your gosh-darn jokes. He put some wire mesh between the filament and the plate and found he could get gain – amplification. A little power on the grid induced a much larger amount of power in the plate circuit – like a valve controlling a stream of water. In fact the British did call it a valve and still do. DeForest called it an 'audion'. We had to be different so we gave it the name 'vacuum tube' or simply a 'tube'. Actually 'bulb' would be better but we're now stuck with the word 'tube'. Doesn't mean what it says."

"You know, Beanpole, I wish I had met DeForest. Once I had an introduction to him from a friend of my father's who was his uncle by marriage but I never got through to him. A man who'd been a fellow student at Yale said there was a sloppier side to him that nobody saw. Said he could mess up a lab worse than anybody else."

"I guess everyone has some weak points. 'Feet of clay' you know."

"Well now that they had vacuum tubes what did they do with them?"

"The first use, I think was in long distance phone lines. They'd been able to get good voice communication for about a thousand miles, New York to St. Louis, for example. They'd even stretched it to Denver, two thousand miles, but that was the limit. With vacuum tube amplifiers at Chicago and Denver they got through to San Francisco for the opening of the 1915 World's Fair. What d'ya think of that? They opened the line with Bell at one end repeating that original sentence 39 years earlier. 'Mr. Watson come here, I want you.' The answer came back: This time, though, it will take a little longer Mr. Bell.' "

Lank continued, "A year or two after that the Navy worked out the problems of radio telephony – generating a radio frequency carrier, modulating it with amplified voice, then demodulating at the receiver. They managed a two way conversation between Washington and Honolulu."

"I heard about that, Lank, from my mother's cousin who was a professor at Yale. He told about helping a boy set up an amateur receiver. Then, right in the middle of the dots and dashes, they suddenly heard a voice saying that music was going to be broadcast that night. That must've been about 1918."

"Boy, that sure was progress!" I continued.

"About 1923," I continued, "there were several stations on the air that I knew about and I got my first radio. It had two metal cabinets: one held the tuner; the other, three tubes. Also had a cone speaker on top. It ran on batteries. I still have it."

"That sure is an antique, Hank. You

ought to hook up some new batteries and turn it on again. See what happens."

"That's a good idea but it wouldn't be easy. It kind of died. First year you could hear it all over the house. After three or four years, though, it faded out until you could hardly hear it in the same room. Somebody figured there was corrosion inside the audio transformers. Then too, where would you get UV-199 and UX-120 tubes today? The old ones are no doubt as dead as a door nail."

"Guess you're right. Still wish you could make it work. Sort of liked the scratchy tones that came out of it." He uncoiled his feet one way, then coiled them back the opposite way.

"About 1926 or '27," said Lank, "they came up with sets that would work on a-c house current. But with me in college – my folks weren't spending money on a new radio. Sometime about 1930 I bought another battery-radio, second hand. Guess I paid mebbe five or ten dollars. It was better built and more compact than the first one. The darn thing lasted until we got an a-c radio in 1936, a big console model with a built-in loudspeaker. You could even switch to several short wave bands. I remember we sometimes got news broadcasts from London and heard Big Ben."

"But what's that got to do with computers?"

"Well, you'd never have had computers without them vacuum tubes. Up until the 1920's the only use for vacuum tubes was for speech or music or radio. Then they started using vacuum tubes for other things. In another twenty years we ended up with computers."

"I read somewhere," I said, "that the Union Switch and Signal Company were the first to use vacuum tubes for something other than entertainment. They developed an automatic stop system for railroad trains where pickup coils on the locomotives sensed an a-c signal in the rails, used vacuum tubes to amplify what they had picked up which then operated a relay. Guess that was about 1926."

I took another sip of coffee. "But they weren't first by very much. You remember the talkies – talking movies – about 1927? To keep the pitch of the sound right they had to control the playing speed accurately. Western Electric built a theatre sound system that controlled the speed with four vacuum tubes. We'd call it a 'servo' today."

Lank drained his coffee cup, held it out for the counter girl to refill. He always takes refills when they're free. "That wasn't the only servo back then," he said. "While I was an undergrad at MIT, Professor Arthur C. Hardy got a lot of publicity for his color analyzer, 'automatic spectro-photometer' he called it. The machine produced a plot, and the motor that drove the plotting pen was in the plate circuit of a pair of vacuum tubes."

"Yep, Lank, I remember, Hardy was a neighbor of mine, lived just a few doors up the street. He used to tell me about it too. I was an undergrad at Harvard then, majoring in physics. I remember the physicists saying that there were all sorts of experimental systems that were fine in theory but had too much energy loss to be useful. Vacuum tubes provided gain and made a lot of systems practical."

"Well of course you cloud nine Havard Men, what do you know about making things practical? Now at MIT we were always looking for something that could be useful."

"Lank, you remember that story about Faraday when he announced his discovery of electromagnetic induction? Somebody asked him 'Of what use is it?' He answered 'Of what use is a baby?' Everybody who uses electricity from a generator today uses Faraday's discovery. But how many of these people even know who Faraday was?"

"Yeah. And who invented the doughnut? Facts have a way of getting buried in the sands of time."

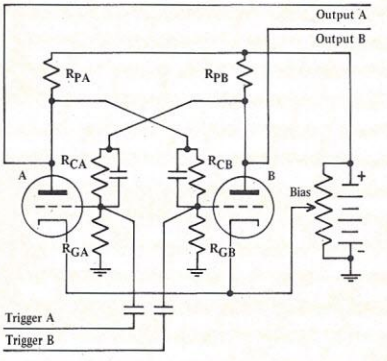
"Right, Foureyes," said Lank, kicking one leg out in the air to get the circulation going. "One generation's advance in science becomes the next generation's thing-you-can't-do-without. But for every advance in science there's a heluva lot of engineering needed to bring it down to earth."

"That's your flametop personality showing," I said. "Remember I'm an engineer too in spite of Harvard. So anyhow the next step toward computers was World War Two. Guess everybody agrees on that. That brought radar, and for radar you needed vacuum tube circuits to act as switches turning on and off a thousand times faster than you could work a mechanical switch. That was the beginning of what you could call digital circuits."

"Ayuh, as you Yankees say, that was it. I remember particularly a circuit called a flipflop in a book by Professor John G. Brainerd of the University of Pennsylvania. He a relative of yours?"

"Not very close. Probably about like you and the Duke of Norskefjord."

"You might be surprised, I'm second cousin to somebody, I can tell you that. Don't know who – but somebody. Anyhow the circuit went something like this." He made a sketch on an envelope, (see figure.)



" It's a long long time, Hank, but I still remember. It works something like this: If one tube is conducting, then the connection from the plate of each tube to the grid of the other tube makes the other cut off. Say A is conducting and you want to change to be B, then a positive pulse on Trigger B makes B conduct and A cut off. I knew that much, and sometimes I designed test equipment for stuff with flipflops in it, but how you designed one or how you fixed it if it it had trouble I never knew. It seemed more like black magic than electronic engineering."

"I felt that way too," I said. "But the flipflop was what led to the computer. Within a couple of years your cousin John G. Brainerd built the first electronic computer out of several thousand flipflops. He called it the ENIAC for Electronic Numerical Integrator And Computer. They used it at Aberdeen Proving Ground to compute the trajectiories of shells."

"Well," said Lank, standing up. "I guess I gotta run. My bad leg is kicking up again."

With that joke still ringing in my ears, he skooted out just in time to let me pay the check. I'll get him next time, believe me. □

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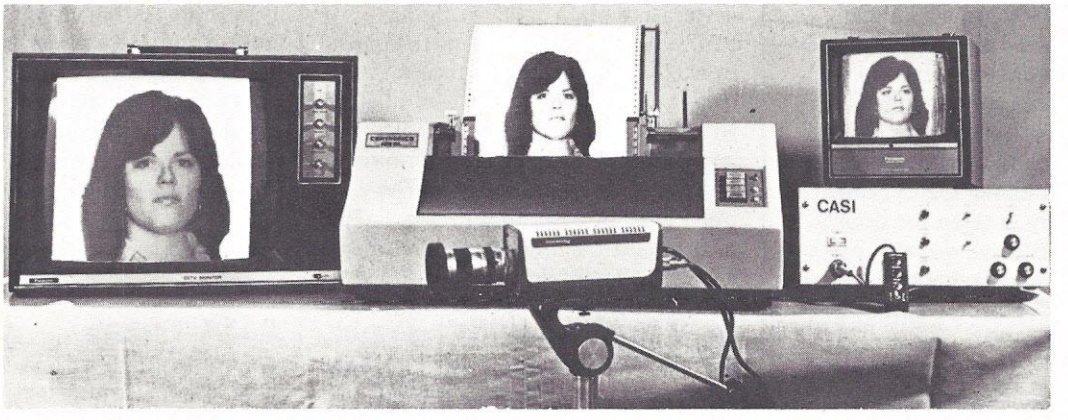

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P

CIRCLE 8

PET vs. TRS-80

BY PAUL WIENER

Two completely assembled computers are now available for under $1000: the Personal Electronic Transactor 2001 (PET) by Commodore Business Machines and the TRS-80 by Tandy Corp. (available through Radio Shack outlets).

Each complete system includes CPU, CRT display, power supply, ROM operating system with BASIC and cassette mass storage. The PET incorporates all these features into one decorative, metal-encased unit. The TRS-80 consists of four separate business-like units connected by cables: a keyboard containing the CPU and primary memory, a video monitor, a cassette unit and the power supply. There are no hidden expenses in either case unless you count the cost of a few high quality audio cassettes for program and file storage, head cleaning and demagnetizing paraphenalia (available for under $10) and lens cleaning spray for the display screen.

Because of the great differences between Radio Shack's Level I and Level II, in this article I'll compare the 8K PET ($795), the TRS-80 Level I ($599 with 4K; $899 with 16K) and the TRS-80 Level II ($698 with 4K; $988 with 16K).

Expansion

Radio Shack already offers a broad line of peripherals including an expansion interface, quick printer, impact printer and mini-floppy system. Commodore is also developing a line of peripherals including a second cassette, an impact printer with PET graphics, a mini-floppy and a full-size diskette system.

The PET comes with four separate built-in interfaces: IEEE 488 bus interface, parallel user port, second cassette interface and memory expansion connector. Many non-Commodore peripherals are already available for the IEEE 488 bus, but because this bus structure is oriented toward intelligent peripherals they tend to be expensive. However, the line that Commodore is currently developing will have the necessary smarts (according to Commodre, at least one microprocessor per device) at a price in line with the PET's. At least two kinds of IEEE 488 to RS232 connectors for the PET enable it to drive devices such as a Selectric terminal. One connector costs under $200 and enables the terminal to be used as a dumb printer. The other adapter costs about $285 and allows duplex communication between the Selectric terminal and the PET. Sources include V NET WORKS, 5014 Marragansett #6, Sandiago, CA 92107 and The Computer Factory, 790 Madison Avenue, New York, NY 10021.

The Mostek 6502-based PET can address up to 32K primary memory. Commodore is not now selling the additional memory boards to go beyond the PET's internal 8K RAM. To expand PET memory inexpensively, watch for magazine ads offering PET to S100 bus adapters or memory boards.

The Z-80-based TRS-80 takes a single expansion interface ($299), which allows it to interact simultaneously with up to four floppy drives, a line printer and extra RAM for up to 48K primary memory. The interface also contains a real-time clock, standard equipment on the PET. Radio Shack's modem, called Telephone Interface I, requires the interface unit and costs $149. This device allows long-distance communication between your computer and other computer equipment.

BASIC Features

A comparison of PET vs TRS-80 BASIC can go either way depending on whether you compare Commodore's 8K BASIC to Radio Shack's 4K Level

TRS-80's typewriter-like alphanumeric keyboard

I BASIC or their 12K Level II BASIC.

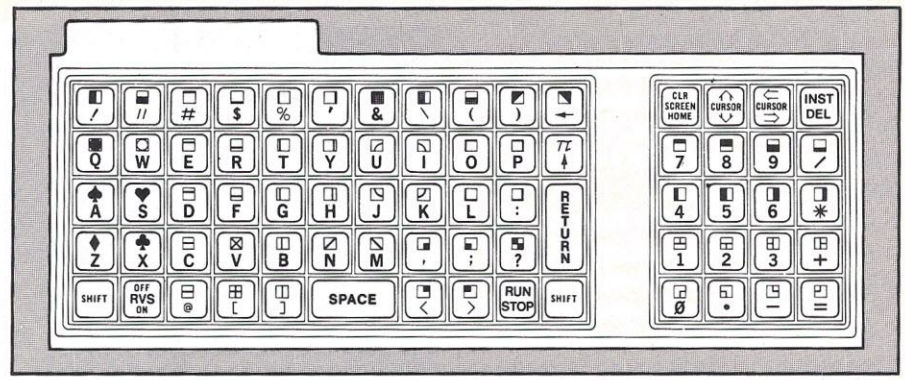
Level I has about 45 commands; PET BASIC about 69 commands; and Level II about 95 commands. I'm not counting Level II's disk commands, which would bring the total up to about 120; the PET will also use additional commands when used with a floppy system.

Level I does not feature exponentiation, so the quickest way to code 7^3, for example, would be X = 7*7*7. The Level I user's manual provides a listing for many commonly required function subroutines including exponentiation, square root, logs (natural and common), tan, cos, sin, arc cos, arc sin and arc tan. Most of these functions are available in Level II as BASIC commands.

Level I BASIC has 27 command input abbreviations. In Level II, only PRINT has an abbreviated form. Almost every command in Commodore BASIC has an abbreviation. Level I's abbreviated command format is certainly a plus from the point of view of operator convenience. However, Level I stores each command in program memory in its long form even if it was entered as an abbreviation. In contrast, PET and Level II store every command as a single character. Thus the PET and Level II are more memory efficient.

Level I has only three error messages: "WHAT", "HOW", and "SORRY". Level II has 23 error messages and Commodore has about 26. Level I does have a useful error message feature which is missing from the other two BASICs. When an error condition is encountered during a program run, execution stops and the offending line is automatically listed with a question mark inserted *inside the line at the point of the error.* This feature can be a terrific time saver when you run into an error in a long multi-statement line.

Level II abandons this convenience, yet its error recovery and debugging flexibility go far beyond Level I's and Commodore's because of its advanced BASIC features. For example, ON ERROR GOTO, ERL, ERR and RESUME statements allow you to continue execution after an error condition arises. These statements cause the program to branch depending on the type of error and where in the program the error was encountered. TRON and TROFF control a trace mode which prints the number of each line as it is executed during a program



PET's calculator-style alphanumagraphic keyboard

run. This extremely useful debugging feature can be called and dismissed under program control for selective traces of problem areas in otherwise error-free code.

In most instances, a feature-by-feature comparison of the three BASICs yields this generalized evaluation:

Level I < PET BASIC < Level II

The only serious flaw in the PET's operating system is the notorious PET "hang-up". Every so often during editing, the cursor vanishes and the PET loses all responsiveness. The only fix is to turn the PET off and back on, thus losing all unrecorded data and programs. A new ROM which eliminates this problem is available from Commodore Business Machines, Inc., 901 California Ave., Palo Alto, CA 94304 for $10 plus shipping (even if your PET is still under guarantee).

However, you can skirt this "hang-up" difficulty without any expenditure. According to the Computer Factory in New York City, the PET loses responsiveness only during editing on the bottom line of the CRT. Since I've avoided editing on the bottom line, the problem has practically vanished.

The PET seems superior to both Level I and Level II in processing speed. I bench marked all three with this program:

```
10 FOR X = 1 to 10000
20 NEXT X
30 PRINT "DONE"
```

TRS-80 Levels I and II each required about 21 to 22 seconds to complete the program. The PET required between 11 and 12 seconds. Speed may be the most dramatic single difference between the two computers. Processing time is relatively unimportant in many games and most business applications; the great time eater is extensive input and output. On the other hand, some games and business applications and most scientific calculations have a high processing-to-I/O ratio which emphasize the need for processing speed. If run time is of paramount importance for you, you should choose PET.

Level I and the PET are less precise than a good 10-digit scientific or programmable calculator. For example, my TI-59 displays numbers with up to 10 significant digits and retains 13 digits internally. Level I has 6-digit precision; Commodore BASIC has 9-digit precision; Level II's double-precision displays 16 significant digits and retains 17 internally. My calculator can handle numbers up to 9×10^{99} with algebraic notation. Level I, Level II, and Commodore BASIC all overflow somewhere between 1×10^{38} and 1×10^{39}. "PRINT 7↑2" returns "49.0000001" on the PET, is not allowed in Level I and returns "49" in Level II.

Level I offers standard BASIC editing features such as eliminating a line by typing the line number and the new version of the line. Commodore BASIC's insert and delete feature expedites matters considerably. Level II's edit mode allows all of the above plus a number of other advanced editing operations. For example, nSc searches for the nth occurence of character c in the line you're editing and moves the cursor to that position. nKc deletes all characters up to the nth occurence of character c and leaves the cursor in that position. Further examples: AUTO provides programmable line numbering and the IF THEN ELSE command is more conducive to structured programming than Commodore's and Level I's IF THEN. Also, print formatting capacity is featured in Level II, but omitted from the other two BASICS.

Level I's single one-dimensional array can use all the memory not pre-

empted by variables and program memory. With good programming, you can simulate more than one array or multi-dimensional arrays. The Level I manual gives examples of such programming techniques.

PET BASIC allows as many dimensioned arrays as there are variable names. However, each array is limited to 255 elements. Again, programming tricks can help sidestep the limitations. Commodore suggests using several arrays to replace one large multi-dimensional array, packaging your values (See *Expanding Your Galaxy* by Ward, *PC,* Vol I, No. 5, Sept/Oct 1977) or changing your algorithm to dispense with arrays entirely.

Combining the best of both worlds, Level II allows a large number of dimensioned arrays, each of which may expand to fill available memory. None of the three BASICs has built-in matrix manipulation, but the Level II manual lists some matrix manipulation routines.

Level I is restricted to two string variables. The other two BASICs allow the addition of the string declaration character ($) to any variable name.

Keyboard, Graphics and CRT

Keyboard design represents a major difference between Radio Shack and Commodore. The TRS-80 has rugged typewriter-like alphanumeric keyboard. An advantage of the Level II keyboard is that it has roll over.

PET has the controversial alphanumagraphic keypad. PET's keyboard is about 9" (including the 7/8" gap between the alphabetic keys and the calculator-like numeric keypad) by 2-5/8". The keys sit almost flush with one another but taper near the top to produce an effective separation of about 3 mm between key-tops. Because each keys' surface measures about 1 cm^2 touch typing is difficult but after working on my PET for three weeks I found I preferred it to a "normal" keyboard.

The PET keyboard offers all 64 ASCII characters without shift, which helps offset the initial keyboard awkwardness. But unfortunately, this advantage is reversed when using the lower-case letters. You must hold the shift key for all the lowers – releasing it gives caps. I also find the gap between the letters and the numbers cumbersome when inputting mixed alpha and numeric code.

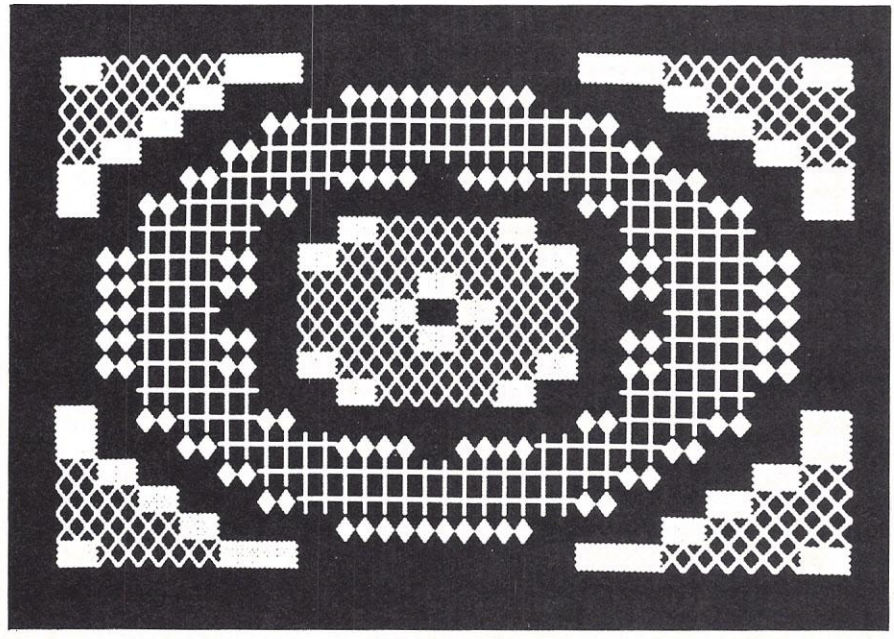


Photo by the author

An example of PET's graphics capabilities

PET's delicate-looking plastic keyboard at first appeared a lightweight compared to the TRS-80 keyboard's durable appearance. The PET comes with a clear adhesive plastic film capping each key for protection during shipping. Until you remove this film from each letter, the key tops may look like they're peeling off, thus reinforcing the overall impression of light-duty construction. After using my PET more than a month I see some cosmetic wear on the return key surface. To prevent more wear from developing, I keep the keyboard covered with a sheet of Saran Wrap taped in place; this also protects against accidental spills. I've also worked on demonstrator PETs in the Computer Factory, one of which has been in use now 8 hours a day every business day for about 6 months. Their keyboards so far seem mechanically reliable, respond to a light touch and give good tactile feedback. The same holds true for demonstrator TRS-80 keyboards I've used – though I noticed an occassional tendency for a key to register twice on a single stroke.

One ironic mechanical imperfection in the PET concerns two keys made double size for user convenience: RETURN and SPACE. Because these keys have only a single electrical contact like the other keys, you must hit them squarely in the middle to be sure they'll register. Whoever arranged this little miracle of modern design should RETURN from SPACE.

The PET graphic set has generated a great deal of interest in home computer circles. The upper case of all but 11 of PET's 73 keys (counting 2 shift keys) feature special characters which print unique graphic fields on the CRT (or Commodore's printer). Many of the graphics cannot be displayed at the same time as the lower case letters; others can be displayed only when in the "lower case mode", the rest in either mode. (For an example of PET graphics in a computer art program, see above.)

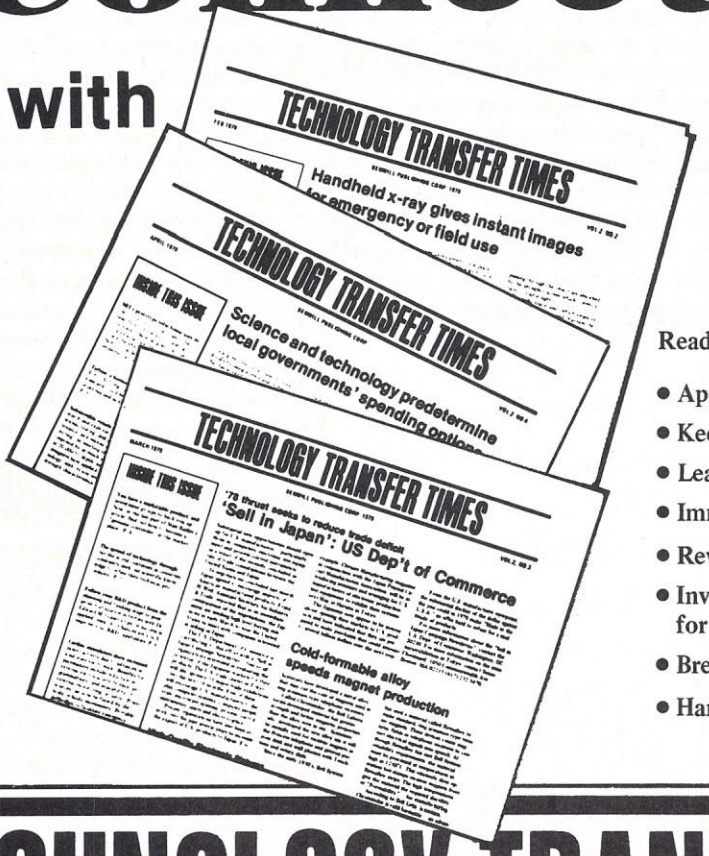
Each character, including the space, can also be displayed "reversed field". PET graphics can do many useful and fun things, but don't expect them to take the place of a plotting terminal or to reproduce the displays we see in some ads. There's no user access to the dot matrix.

The finest resolution figure available for a continuous plot on the PET is a quarter-character "point". The same is true for the TRS-80. TRS-80 graphics must be built up from these points and from the conventional character set which limits TRS-80 compared to PET. Yet, at a TRS-80 show, I saw an impressive animated demonstration: a cartoon schoolbus crossed the 80's screen on its way to a school. When the bus arrived, the school raised a flag.

TRS-80's point measures about 1/16" by 1/4". A PET point measures about 1/16" by 1/8". TRS-80 points are referenced by a screen coordinate address. PET points can be addressed in a similar fashion through POKE commands, but this results in too much visual noise. So normally, you'd use cursor control com-

Get The Connection

with



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mands to reference the PET's points. I think the TRS-80 system is more convenient.

Another factor reducing the PET's graphics superiority is its smaller CRT size. PET's 9" display holds 25 40-character lines (1000 characters). Radio Shack's 12 incher displays a 64 by 16 character format. (Level II allows you to select a 32 by 8 character format if you desire). The actual difference in character count is only 1000 versus 1024; but for those of us without printers, the TRS-80 has a slight advantage for displaying plots, tables and so on. Also, many published programs assume a 64 by 16 display format. These programs usually require some rewriting to run on the PET. Except for the size, PET's CRT provides an excellent high resolution display, perhaps a little sharper than the TRS-80's.

Cassette storage

Commodore and Level II cassette management provide write redundancy, error detection and recovery and file lables. Level I offers none of these features. The PET also features a modified "stripped down" cassette drive. The TRS-80 has a digital cassette index.

A disadvantage of the TRS-80 is the necessity of disconnecting the control cord from the keyboard/CPU to the cassette player for rewinding. You can circumvent this "necessity" by fooling your TRS-80 into turning on the cassette drive. Key in a cassette SAVE or LOAD command and then press REWIND on the tape unit.

PET's operating system has some minor bugs which require you to use special routines when writing files on tape; otherwise, data may be lost. These routines are listed in Commodore bulletins and *PET User Notes,* Vol. 1, No. 1. In the PET's documentation, Commodore acknowledges the problem, announces that it "is being worked on" and provides the aforementioned subroutines as a temporary fix.

Serviceability

Radio Shack's extensive distribution system seems to put it in a better position to provide quick local service. Indeed, a number of TRS-80 regional repair centers are already established throughout the country. Commodore says they too have some dealer repair facilities. However, they don't seem to be as easy to locate as Radio Shack's. Commodore plans to make every PET dealer a service center eventually. In the mean time, Commodore promises that any PET sent to their center in Palo Alto will be repaired and shipped out within a few days. But the transit time to California and back is still greater (for most of us) then the shipping time to a local facility.

Many of us who read earlier articles about the PET are under the impression that a PET could be serviced by any TV repairman who read a PET service manual. A Commodore representative told me that this is a "misunderstanding". What was meant was that the TV repairman could service the CRT.

Differences in the two computers should suggest a preference depending on your particular application or situation.

However, the 1K of diagnostic routines programmed into the PET's ROM, coupled with the PET's modular construction, should make most repairs a snap (literally), *if* you have the special hardware and information needed to run the diagnostics.

In contrast, if you so much as blow a fuse on the TRS-80, its power supply has to be taken back to a Radio Shack store and then shipped to a repair center. (Changing your PET's fuse is as as easy as opening a child-proof medicine bottle – if you can locate a 1.6 amp slo blow fuse; in a pinch, a 1.5 amp slo blow will do.)

In a sense, the question of maintenance fits into the larger picture of customer service. My only personal contact with Commodore's corporate face is a number of phone conversations with Commodore's customer service department ((415) 327-4030) in Palo Alto, California. The people I spoke to were courteous and helpful, answering my questions clearly and intelligently. When the person who could answer my question wasn't present, I was told I'd be called back later that day on Commodore's WATS line when that person returned. The last time I called, a Commodore representative called me back less than an hour later and gave me a well-researched answer to a series of questions. However, the other times that Commodore said they would call back I stayed home and kept the phones clear until closing time in California, but the call never came.

I made an experimental call to Radio Shack's customer service number in Fort Worth, TX ((817) 390-3583). To the person who answered I said "I'm calling about the TRS-80. This is an expensive call for me. Can you call me back?" A voice asked me if I was a Radio Shack manager. I said "No, I'm a customer." He took my name and phone number cheerfully and called me back within half an hour.

Software & Documentation

Radio Shack is ahead in programs currently for sale. They offer a number of games and business and home management programs, as well as T-BUG and Editor/Assembler.

Commodore entered this market with a mailing to PET owners offering about 16 programs for sale. There are many programs already available for PET and Radio Shack from private software companies.

Commodore is readying the PET's "final documentation". Current PET documentation is sketchy at best. Meanwhile, Radio Shack keeps the lead. The Level I manual is excellent as a BASIC primer. The Level II manual assumes you already know a little bit about BASIC programming but is very lucid.

Summary

Though neither the PET nor the TRS-80 holds a general superiority, their numerous differences should suggest a preference depending on your particular application and situation. If portability, fast processing, aesthetics and graphics are factors in your decision, the needle points towards PET. It swings towards Level II, however, if you want more than 32K primary memory, extra advanced BASIC features and quick service available *today* (PETs may be fixed faster in the future). If an absolute minimum of expenditure is your determining criterion, then you should consider the Level I TRS-80. □

8K BASIC in PROM for 6800 Systems

BY DR. SAMUEL I. GREEN

Typical home computer systems are turned on dumb and made intelligent by playing software from magnetic tape into read-write memory (RAM). If the software were put into non-volatile read-only memory (ROM), programs would be ready when the computer was turned on, the so called "turnkey" system. Furthermore, RAM originally dedicated to program storage would be available for operation, making the system effectively much larger.

For various reasons a program in RAM may not simply be put in ROM. Some programs use self-modifying code. That is, some memory locations change their contents during operation. Others require RAM within the addressing range encompassed by the program. If such a program is put in ROM, either some RAM must be placed within the addressing range or the program code referring to these locations must be changed to refer to RAM at another location.

Let's see how to put into ROM a program intended for operation at the bottom of 6800 memory which includes a direct addressing feature from 0000 to 00FF (hex). In particular, let's look at the task of putting SWTP 8K BASIC version 2.0 into ROM at the bottom of memory.

Figure 1 shows a memory map of SWTP 8K BASIC version 2.0 written by R. H. Uiterwyk. It's typical of 6800 programs: the direct addressing range is reserved for scratchpad RAM and the program begins at 0100. The interpreter extends from 0100 to 1DBO with no self-modifying code and is compatible with ROM. The region from 1DB1 to 1EAE is used as a string buffer and a machine stack which both require RAM. The user program storage extends from 1EAF up through the top of contiguous RAM.

Figure 2 shows the circuit of my ROM board using eight 2708 PROMs for 8K of non-volatile program storage and two 6810 RAMs for the direct addressing range. Three 74S138 three line to 1 of 8 decoders are used for address decoding. The first selects the 8K block at which the memory operates. The second selects which 1K of memory is selected. The third divides the first 1K of memory into eight 128 bit parts. The first two lines select the two 128 x 8 RAMs. The remainder are combined to select the remaining 3/4K of the first PROM. (A 74S138 is used in lieu of simpler gating to select the first 8K block to allow changing to operation at higher address in the future. In that case, the RAM at the bottom of memory would be deselected by addressing the first PROM as shown by the dashed line in Figure 2.)

The task of overlaying RAM addresses on ROM, as done above for the direct addressing range, is not applicable to the RAM required above the interpreter. The addresses in this case, and in general, are not in blocks of convenient size. Therefore, this memory range was changed to start at 2000 in RAM as shown by the memory address map in Figure 3. All references to the memory range from 1DB1 to 1FFF were found in the program and changed to the values shown above 2000. This task was not difficult as there were only 17 bytes of 1D or 1E in SWTP 8K BASIC version 2.0 and most were eliminated by inspection of the following byte. I needed 7 address changes to move the RAM locations from starting to 1DB1 to starting at 2000. These changes are listed in Figure 4.

Also listed in Figure 4 are two other required changes. The byte at 0155 provides a backspace on control-0 for overwriting typing errors. The seven bytes at 03A6 are a patch to allow operation with SWTBUG and an ACIA serial interface.

Figure 1

SWTP 8K BASIC Version 2.0 Memory Map

0000-00FF	Input buffer and temporary variable storage (direct memory addressing range)
0100-1DB0	BASIC interpreter
1DB1-1EAE	String expression buffer and machine stack
1EAF –	User program

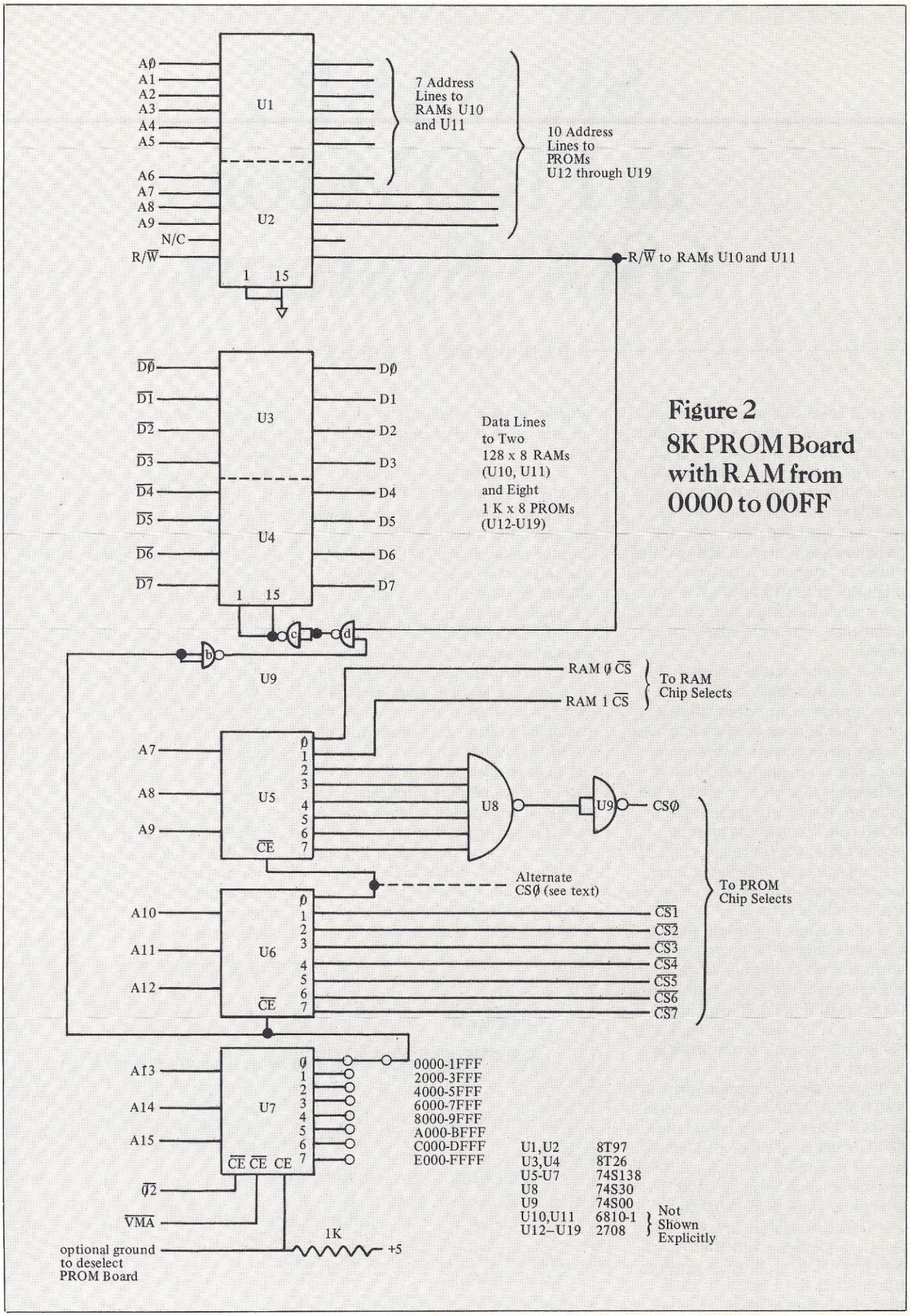

Figure 2
8K PROM Board with RAM from 0000 to 00FF

Figure 3 Memory Map Changes

0000-00FF	Input buffer & temporary variable storage (RAM)
0100-1DB0	BASIC interpreter (ROM)
1DB1-1FFF	Unused/available for future expansion (ROM)
2000-20FD	String expression buffer and machine stack (RAM)
20FE-20FF	Two bytes wasted to achieve round numbers (RAM)
2100 –	User program (RAM)

Figure 4 Program Changes

LOCATION	CHANGE FROM	TO	
OE36	1DB1	2000	
OC34	1E2F	207E	
1515	1E2F	207E	
15DE	1E2F	207E	High memory buffer and stack references
15E5	1E2F	207E	
014E	1EAF	2100	
153C	1EAF	2100	
0155	5F	00	Backspace
03A6	2B 12	47	
	DF 8A	24 11	SWTBUG ACIA SERIAL INTERFACE
	CE 8004	DF 8A	
		DE 90	

This circuit is for operation of PROMs only. No provision is made for the programming or burning-in of PROMs, which was accomplished in a separate circuit. ("Exorciser acts as EPROM Programmer", H. W. Louie and E. L. Bailey, *EDN*, 20 November 1977, pp. 28-34. I had to rewrite some of the code to run this program with SWTBUG or MIKBUG.)

The PROM burning procedure follows:

1) Load BASIC into 8K of RAM starting at 0000.

2) Type "G" to start BASIC. Terminal responds with "READY" and a prompt (#). This step is essential. If code is modified before BASIC is started, a "LOAD ERROR" results.

3) Press Reset switch (or patch back to monitor).

4) Use the memory change function to change the code in accordance with Figure 4.

5) Type "G" to start the modified BASIC.

6) Type "NEW". This command imposes the new changes on some page zero RAM. Otherwise the first new program still starts at 1EAF.

7) Press Reset.

At this point, I changed the starting address of the 8K RAM with modified BASIC from 0000 to 2000 and opened the write-protect switches to protect it. My PROM-burner program then uses the lower memory addresses. The data is transferred in 1K blocks from 2000 to 3FFF.

I wish to thank Joe Turner and Warren Startup for their help. □

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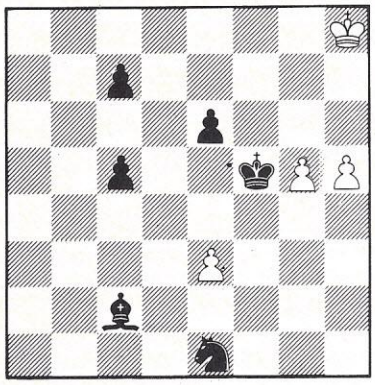
CIRCLE 41

Botvinnik on "Man and the Computer"

(One of the world's greatest chessplayers discusses End Game Logic during his visit to the 1977 World's Computer-Chess Championship Tournament at Toronto.)

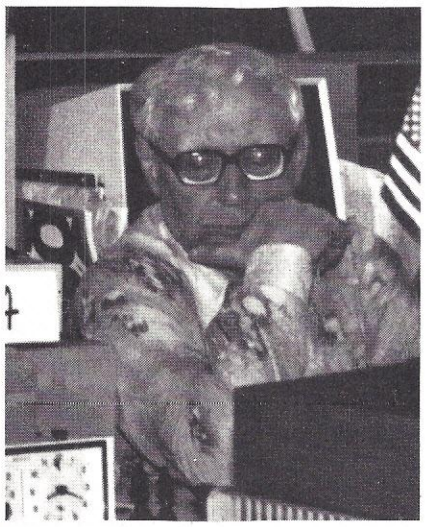
During the Toronto computer-chess tournament, **Dr. M. Botvinnik**, of Russia, watched the proceedings from the sidelines. He is currently at work on his *PIONEER* chess program which, he says, is not yet ready to play. Forty years ago, **Dr. Botvinnik**, then a teenager at the height of his fame as world-renowned master, was listed among the greatest chess players of all times. Before he departed Toronto **Dr. Botvinnik**, currently professor of EE at Moscow University left behind some interesting personal thoughts about "Man and Computer." The thoughts come to us by way of Mike Valenti.

Dr. Botvinnik also left behind a demonstration end-game problem which is solved by "Pioneer." Following is a diagram of the problem. Answer to the problem of White to play and win, can be found at end of this article. The White win requires 3½ hours computing time. This slow time for the computer, says Botvinnik, "will be improved."



Botvinnik end game problem to be solved by his "PIONEER" program.

"Nowadays the computer assists man in solution of diverse problems," writes Prof. Botvinnik. "Here we discuss the solution of diverse problems with cut look-ahead tree; i.e. problems of control theory. There are two methods to solve such problems; one



Botvinnik, of Russia, watches a computer-chess game at last year's world tournament at Toronto. The famous chess master is currently engaged in developing a computer program called "Pioneer"

was used by man since the dawn of history; the other is now used by computers. The look-ahead tree in a man's brain is small; that of a computer is rather large. Man never takes into consideration available possibilities, a fact that is evidently absurd. The computer on the other hand, makes full use of all possibilities. Thus, a chess master's look-ahead tree consists of some 100-200 nodes; while the computer has several hundred thousands. Man uses his library of experience (his own and that of other people.) This method is naturally closed to the computer because of the immense number of nodes. Which of these two methods can be used to achieve better results? That question will be decided when the computer develops to the point where it can use man's method.

"Pioneer is a chess program based on the principles of a chess master's strategy. *PIONEER'S* library (books of openings, middle games, and endings) corresponds to that of a master's. To find the optimal variation *PIONEER* forms a small look-ahead tree. With artful apparatus it expels those moves not worth considering.

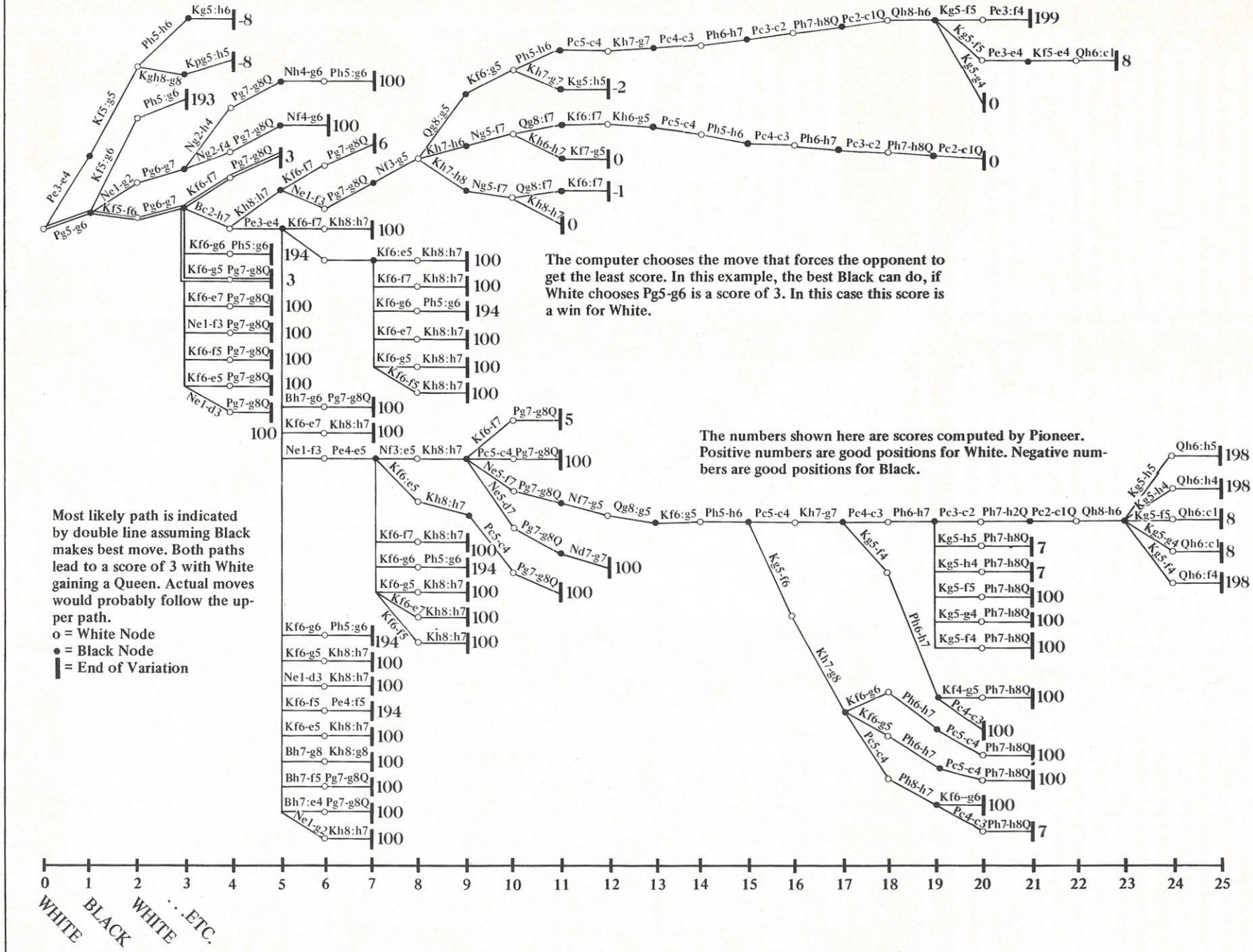
"How does *PIONEER* create a small tree? Unlike other programs, *PIONEER's goal* is a game intrinsically connected with a cut of the tree. This goal is seen only within the limits of horizon (the limit time, in plies needed to achieve the goal). *PIONEER* conceives a chess game as a three-level control system: 1) pieces with their tracks, 2) sets of pieces (game - zones) united by a common goal and 3) sets of zones (mathematical map of the position). Setting of zones and tracks into the scan depends on a stated priority. Positional value is counted on the basis of the control of squares on tracks where there has been no play yet; thus it has an individual character for each position.

"The library is used three ways: 1) in the opening the reference method is used, 2) in the middlegame the common elements of current position are considered depending on direction of study introduced by the librarian of study, and 3) in the endings the program also tries to reach the library position and, if reached, the variation is evaluated immediately.

"*PIONEER* has solved only three endgames, and those not without some trouble. Its look-ahead tree differs from a master's mainly because positional value is still being programmed. At first we thought that such a tree was not as important in endgame solving, as it is in a game. It appears now that for endgames it is also important. The look-ahead tree of an endgame has 50-200 nodes. The speed of endgame-solving is rather slow. Probably to reach the speed of a chess master *PIONEER* needs a 10-15 million-operations-per-second computer.

"We think that *PIONEER* will not only use methods similar to a human's but also it will possess similar power and speed – if a powerful computer be used. It's already known that for other programs, computer abilities do not have great influence.

Botvinnik's Hand-Drawn Map of "PIONEER" Printout



"Perhaps the chess model will achieve the same role in cibernetics as a drozophilus fly does for genetics. When the work upon *PIONEER* is successfully concluded we will be able to finish the theory for the solution of look-ahead problems (the theory of multilevel control). On the basis of this general theory it will be possible to realize the artificial intelligence in those diverse realms where it has its practical significance. Naturally powerful computers will have to be used. Perhaps, to achieve better results, special computers will be designed for look-ahead problems in general or to solve one particular problem.

"It is to be hoped that the cooperation of cybernetic and computer-scientists will lead us through this complicated 20th century to the achievement of good optimal solutions and thus to the well-being and justice to humanity."

A background on Dr. Mikhail Botvinnik for those unfamiliar with his enviable reputation in chess can be found in Irving Chernev's book: "Combinations: The Heart of Chess" © 1960 by Irving Chernev, published by Thomas Y. Crowell, NY. (Paperback available from Dover Press, NY.) "Select a quartet of the greatest players that ever lived, " writes Author Chernev, "And you would have to include Botvinnik. He is the master most qualified to join the immortal trio, Capablanca, Alekhine and Lasker. Some idea of his style and capabilities may be gained from the comments of chess critics such as William Winter, who says 'He has made himself equally at home in each department of the game: opening, positional strategy, combinative tactics and endplay, so that it is impossible to say that he is stronger in one brand of play than another. His best games have the smoothness of an epic poem, rolling on grandly to their appointed end.'" The following brilliant end-game was played between Botvinnik and Capablanca, at Avro in 1938, when Botvinnik, a Pawn down, starts a combination," writes Chernev. "The combination, blazing and brilliant, is flawless. Had it not been so, Botvinnik would have been torn to shreds by his opponent, the toughest defensive player in the world".

Botvinnik-Capablanca End Game

1 R-K6! RxR

Black must exchange. If instead 1 . . . Kt-K5; 2 KtxKt, PxKt; 3 PxP! wins at once. Or if 1 . . . K-B2; 2 RxKt ch!, KxR; 3 PxP ch, and now there are these possibilities:

(a) 3 . . . K-K2; 4 Q-B7 ch, K-Q1; 5 P-Kt7, and White wins.

(b) 3 . . . K-K3; 4 Q-B7 ch. K-Q3; 5 Kt-B5 ch, K-B3; 6 QxR ch followed by 7 QxQ.

(c) 3 . . . KxP; 4 Q-B5 ch, K-Kt2; 5 Kt-R5 ch, K-R3 (or 5 . . . K-Kt1; 6 Q-Kt5 ch, K-B2; 7 Q-B6 ch and mate at Kt7); 6 P-R4!, R-KKt1; 7 P-Kt4 (threatens 8 Q-B4 ch, K-Kt3; 9 Q-B6 mate), Q-B3; 8 B-R3!, and the threat of 9 B-B8 ch is decisive.

2 PxR K-Kt2

Forced, since a Knight move allows a fatal check at B7.

3 Q-B4!

Threatens to win at once by 4 Kt-B5 ch!, PxKt; 5 Q-Kt5 ch, K-B1; 6 QxKt ch, K-K1; 7 Q-B7 ch, K-Q1; 8 P-K7 ch.

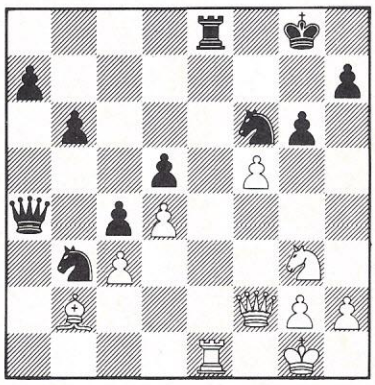
3 . . . Q-K1
4 Q-K5 Q-K2

He must blockade the Pawn. If instead 4 . . . Kt-QR4; 5 B-B1! forces 5 . . . Q-K2, to prevent these two winning threats:

(a) 6 Q-B7 ch, K-Kt1; 7 B-R6.

(b) 6 B-R6 ch, KxB; 7 QxKt, and Black is helpless to ward off the threat: 8 Kt-B5 ch, K-R4; 9 Q-R4 mate.

5 B-R3!



White-Botvinnik, Black-Capablanca
(Diagram shows position as endgame begins)

The first of two sacrifices which had to be calculated with the utmost accuracy to assure the win.

5 . . . QxB

Black must take the Bishop. If instead 5 . . . Q-K1 (5 . . . Q-Q1; 6 Kt-R5 ch, PxKt; 7 Q-Kt5 ch, K-R1; 8 P-K7 wins at once); 6 Q-B7 ch, K-Kt1; 7 B-K7, Kt-Kt5 (7 . . . K-Kt2; 8 B-Q8 ch); 8 Q-Q7!, Q-R1 (8 . . .Q-Kt1, 9 B-Q6); 9B-Q8, and White wins.

6 Kt-R5 ch! PxKt

And he must take the Knight After 6 . . . K-R3; 7 KtxKt, Q-B8 ch; 8 K-B2, Q-Q7 ch; 9 K-Kt3, QxBP ch; 10 K-R4, QxP ch; 11 Kt-Kt4 ch! (a clever interposition which had to be foreseen) and White wins.

7 Q-Kt5 ch K-B1
8 QxKt ch K-Kt1

If 8 . . . K-K1; 9 Q-B7 ch, K-Q1; 10 Q-Q7 mate.

9 P-K7!

Beautiful Play! Botvinnik avoids the tempting 9 Q-B7 ch, K-R1; 10 P-K7 which looks overwhelming. Black, with the knife at his throat, would effect a last-minute escape by 10 . . . Q-B8 ch; 11 K-B2, Q-Q7 ch; 12 K-Kt3, QxBP ch; 13 K-R4, QxP ch; 14 KxP, Q-K4 ch, and draws by perpetual check.

The move actually made keeps the Queen Pawn protected, and prevents perpetual check.

9 . . . Q-B8 ch
10 K-B2 Q-B7 ch
11 K-Kt3 Q-Q6 ch
12 K-R4 Q-K5 ch
13 KxP Q-K7 ch

Clearly, if 13 . . . Q-K5 ch; 14 QxQ ch, PxQ ch; 15 KxP, and White mates next move.

14 K-R4 Q-K5 ch
15 P-Kt4

Destroying the last hope. If 15 K-R3, P-KR4, and the threat of 16 . . . Q-Kt5 mate will compel White to take the draw.

15 . . . Q-K8 ch
16 K-R5 Resigns

Answer to end game problem
White to move and win (variation value 3).

1 Pg5-g6 Kf5-f6
2 Pg6-g7 Kf6-f7
3 Pg7-g8=Q
White wins.

Log Functions in BASIC

BY LAURENCE G. DISHMAN

You need logarithms for almost all higher-level statistics, biology and physics studies – as well as for many other applications. Even if your BASIC doesn't have explicit log functions, you can still take advantage of this powerful mathematical tool by using this program.

For any $x > 0$, the following Maclaurin series will evaluate the logarithm to the base e:

$$\log_e x = \left(\frac{x-1}{x}\right) + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \frac{1}{3}\left(\frac{x-1}{x}\right)^3 + \ldots$$

To calculate the antilog, use this Maclaurin series:

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \ldots$$

In most applications where logs are required, $\log_e$ and antilog$_e$ work as well as logs in any number system. But on some occasions, such as calculating decibels, you'll need to compute logs to other bases. For this calculation you'll find the following formulas useful.

For any number base y and any $x > 0$:

$$\log_y x = \frac{\log_e x}{\log_e y}$$

Therefore:

$$\log_{10} x = \frac{\log_e x}{2.302581}$$

Try writing a program on your own to compute these formulas. □

Program Variables

V, V1	Counter variables used in loop control statements.
X	The argument passed to the subroutines.
X1	The argument equivalent, so that the value of X remains unchanged.
X2	The value of X1 raised to an integer power.
Y	The value returned from the subroutine to the main program.
Z	An intermediate value in the function.
Z2	The value of Z raised to an integer power.

Program Notes

This program was written in Processor Technology's BASIC 5.

Line Number	Explanation
1 - 13	Demonstration program for the log and antilog subroutines.
60030	Is used with 60190 for $x < 1$.
60040 - 60070	Because the function works best for numbers $0.1 \leqslant X1 \leqslant 10$, X1 is repeatedly divided by 10 to bring it into this range.
60080 - 60150	The Maclaurin series is applied to the value of X1.
60160 - 60180	Add $\log_e$ (10) to Y for each time X1 was divided by 10. These lines scale Y up to the proper value.
60190	If $X < 1$ then convert Y to -Y.
60230	No negative values allowed. 60390 takes care of those situations.
60240 - 60270	The subroutine works best in the range $-2.302581 \leqslant X1 \leqslant +2.302581$.
60280 - 60350	Apply the Maclaurin series to the value of X1.
60360 - 60380	Multiply Y by 10 for each time 2.302581 was subtracted from X1.
60390	If $X < 0$ then convert Y to a decimal fraction.

Program Listing

```
SOL  BASIC5

READY
LIST
1     X=1E-6
2     GOSUB 60000
3     PRINT TAB(6),"LOG(",X,") = ",Y
4     X=X*10
5     IF X<=1E+6 THEN 2
6     FOR I=1 TO 3
7        PRINT
8     NEXT I
9     FOR X=-13.81551 TO +13.81551 STEP 2.302585
10       GOSUB 60210
11       PRINT TAB(6),"EXP(",X,") = ",Y
12    NEXT X
13    END
60000 IF X<=0 THEN STOP
60010 REM THIS ROUTINE COMPUTES LOGS TO THE BASE E
60020 X1=X
60030 IF X<1 THEN X1=1/X
60040 V=0
60050 X1=X1/10
60060 V=V+1
60070 IF X1>10 THEN 60050
60080 Z=(X1-1)/(X1+1)
60090 Z2=Z*Z
60100 Y=Z
60110 FOR V1=3 TO 61 STEP 2
60120    Z=Z*Z2
60130    Y=Y+Z/V1
60140 NEXT V1
60150 Y=Y+Y
60160 FOR V1=1 TO V
60170    Y=Y+2.302585
60180 NEXT V1
60190 IF X<1 THEN Y=-Y
60200 RETURN
60210 X1=X
60220 REM THIS ROUTINE COMPUTES E^X
60230 IF X<0 THEN X1=ABS(X)
60240 V=0
60250 X1=X1-2.3025851
60260 V=V+1
60270 IF X1>2.3025851 THEN 60250
60280 Y=1
60290 X2=1
60300 Z=1
60310 FOR V1=1 TO 20
60320    X2=X2*X1
60330    Z=Z*V1
60340    Y=Y+(X2/Z)
60350 NEXT V1
60360 FOR V1=1 TO V
60370    Y=Y*10
60380 NEXT V1
60390 IF X<0 THEN Y=1/Y
60400 RETURN
```

Log functions add power and versatility to the repertoire of your programming commands. If your BASIC lacks logs, use this subroutine instead.

Sample Run

```
LOG(     .000001      ) =          -13.815502
LOG(     .00001       ) =          -11.512924
LOG(     .0001        ) =          -9.2103398
LOG(     .001         ) =          -6.9077548
LOG(     .01          ) =          -4.6051698
LOG(     .1           ) =          -2.302585
LOG(     1            ) =           .0000002
LOG(     10           ) =           2.302585
LOG(     100          ) =           4.6051698
LOG(     1000         ) =           6.9077548
LOG(     10000        ) =           9.2103398
LOG(     100000       ) =           11.512924
LOG(     1000000      ) =           13.815509


EXP(    -13.81551     ) =           .000001
EXP(    -11.512925    ) =           .00001
EXP(    -9.21034      ) =           .0001
EXP(    -6.907755     ) =           .001
EXP(    -4.60517      ) =           .01
EXP(    -2.302585     ) =           .10000001
EXP(     0            ) =           .99999957
EXP(     2.302585     ) =           9.9999989
EXP(     4.60517      ) =           99.999982
EXP(     6.907755     ) =           999.99974
EXP(     9.21034      ) =           9999.9963
EXP(     11.512925    ) =           99999.963
EXP(     13.81551     ) =           999999.63
```

Hamurabi Solver:
The Penultimate In Computer Madness

BY JAMES J. DAVIDSON

Personal Computing Number 1, January/February 1977 contained David Ahl's version of the classic computer game, HAMURABI. For those of you unfortunate enough never to have encountered HAMURABI in one of its many incarnations, let me give a brief description.

You've been placed in charge of the ancient city-state of Sumeria, responsible for its subjects' welfare over a 10-year term of office. Hamurabi, the chief administrator, reports directly to you and requires three major decisions of you each year: (1) To buy or sell land as needed to keep the economy stable and prosperous; (2) To decide how much to feed your people; (3) To direct the planting of seed for next year's crops. Interrelation of the decisions by the program structure demands good judgement on each one to survive the full ten years without impeachment and the stigma of being declared "national fink".

According to Ahl, the program originally appeared at Digital Equipment Corp., written in DEC's FOCAL programming language. The author is unknown. HAMMURABI is actually the correct spelling, but somewhere along the line an "M" was dropped and most people now know it as HAMURABI. I prefer it that way. It seems to carry more of the air of ancient eastern civilization with a single M.

Play of the game is challenging, even for an adult. Few clues for making the various decisions are offered, until you are thrown out of office. You will need considerable experience before you can make it through the full term of office. Children adore the game but have no chance of making it all the way through. For them I've written a program for HP-25 calculators which makes all the decisions needed each year and virtually assures successful, if not "fantastic", performances every time.

Using the calculator program requires three minor changes in the computer program, as shown in Listing 1. These changes, made long before the calculator idea came up, are for reasons of consistency. In each case you are now allowed to sell land or plant acreage to the full limit of your resources, rather than being arbitrarily restricted by an inequality. (My suspicion is that the equalities were dropped by error somewhere along the way.)

Listing 2 is the HP-25 program. If you follow the user instructions precisely (and you must, because it's very easy to lose synchronism with the computer if you don't), then entering each year's total population, the number of bushels in store and the price of land will give you back all the information you need for each decision. First you'll be told how many acres to buy. If that number is zero (if you need to sell some), then you'll next be given the number to sell. If the quantity to buy isn't zero, the calculator (as the computer) skips the sell question and goes directly to the question of feeding your people. Finally, you're told how many acres to plant with seed. Transfer the calculator outputs to the computer and you are on your way to a successful reign.

Because of memory limitations in the HP-25, the strategy is not quite optimum. If, in any given year, you buy land, it will not be planted even if you have enough grain and people to do so. That, however, is the only non-optimized factor, and its effect on the outcome is very small.

How valuable is a human life? That too is involved in the strategy. The final evaluation by the computer places a lower value on a few lives than on acres per subject. You can starve up to 3% of the population and still earn a "fantastic" rating, but not if each subject ends up with fewer acres than he started with. Life was hard in those days, and such an evaluation was probably realistic then.

Today we think differently, and the calculator program, reflecting this, is set up to avoid starvation at all costs. Feeding the people takes highest priority, though it possibly could lead to bankruptcy and death for everyone. If you are so unfortunate as not to have a plague or two, your ratings will vary (occasionally including "fink"). But if your plagues are fortuitous and drain off surplus population at the right moments, you'll hobnob with the Charlemagnes, Disraelis and Jeffersons.

Demonstrating this program to young children is delightful. Those who have played the game before and been frustrated by consistent failure take particular joy in making it through the tenth year. They clearly recognize what they're doing as "cheating" but it's great fun anyhow.

Illustration by Sookyun Rha

One bright child even asked how I managed to connect the computer to the calculator. When I explained that HAMURABI was just arithmetic, and that was what the calculator was doing, the expression "a light dawned" took meaning before my eyes. Now she wants to learn arithmetic so she won't have to use the calculator. All youngsters, incidentally, are responsible for running the calculator and computer themselves, which they do with remarkable proficiency in an amazingly short time. (Tell them that Charlemagne means Big Charley. They love it.)

I, of course, never, never use the calculator when playing HAMURABI. If I seem to be doing so, it's because I need to be sure everything is working properly. Honest, I was only checking . . .

Using a programmable calculator to do the arithmetic in a game that's running on a programmed computer surely ranks with the great follies of mankind. But if this is the penultimate in computer madness, what then is the ultimate? Why, programming the computer to solve its own equation, so that you need only hit RETURN once and out comes ". . .A fantastic performance . . ." □

If you don't have issue number one – now a collector's item – which contains David Ahl's original HAMURABI *program, you can order a copy for the original cover price of $2. We pay postage. Limited numbers available; first come, first served. Don't send cash or stamps; send your personal check or money order to* Personal Computing Magazine, *1050 Commonwealth Ave., Boston, MA 02215. Or you can get a copy of David Ahl's* Basic Computer Games *by sending $8.50 to Creative Computing Press, P.O. Box 789-M, Morristown, NJ 07960.*

Listing 1

```
342 IF Q<=A THEN 350
450 IF D/2<=S THEN 455
455 IF D<=10*P THEN 510
```

Listing 1: Changes to be made in the HAMURABI *program which appeared in* Personal Computing, *Volume 1, Number 1 (Jan/Feb 1977). These changes make the game more consistent and also agree with the HP-25 program in Listing 2. The same changes apply to the* HAMURABI *program in David Ahl's* Basic Computer Games *(Creative Computing Press, 1978), which appears identical in all respects.*

Listing 2

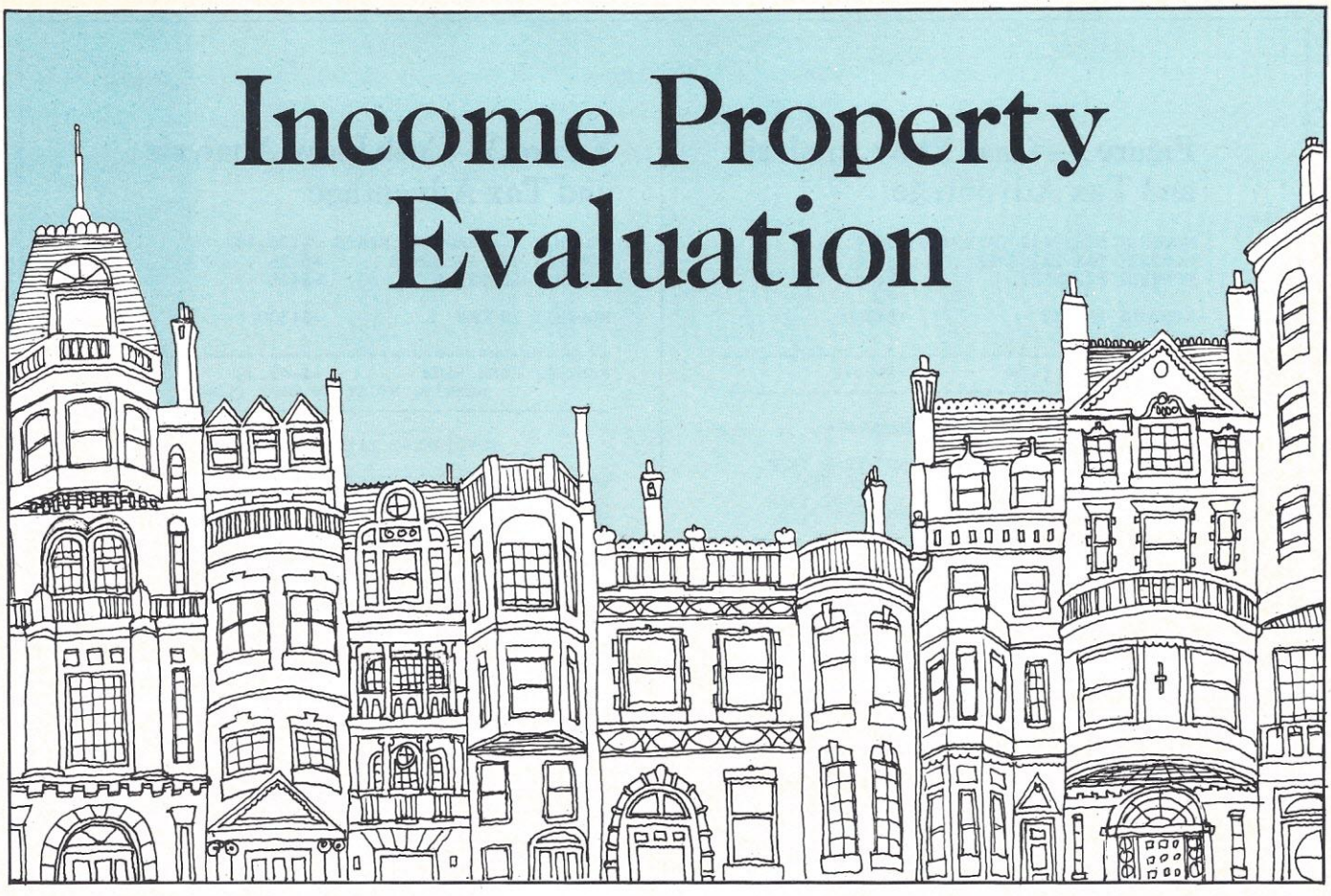
USER INSTRUCTIONS:

1) Switch to PRGM and enter the program.
2) Switch to RUN and key fPRGM, then key R/S.
3) For each year of your reign, do the following:
   a) Enter the total population, then key R/S.
   b) Enter the number of bushels in store, then key R/S.
   c) Enter the selling price of land, then key R/S.
4) Read the number of acres to buy. Key R/S.
   a) If the number of acres to buy is zero, then (and only then) read the number of acres to sell. Key R/S.
5) Read the number of bushels to feed your people. Key R/S.
6) Read the number of acres to plant with seed. *Do not* key R/S, but go to instruction 3a).
7) For a new reign, go to instruction 2).

Listing 2: A program for HP-25 calculator which will solve all the problems of the computer game HAMURABI.

LINE	CODE	ENTRY	LINE	CODE	ENTRY
01	34	CLx	25	1421	f $\bar{x}$
02	33	EEX	26	1551	g x>=0
03	03	3	27	1332	GTO 32
04	2300	STO 0	28	00	0
05	74	R/S	29	74	R/S
06	2301	STO 1	30	1508	g 10^x
07	74	R/S	31	41	—
08	2307	STO 7	32	1571	g x=0
09	74	R/S	33	74	R/S
10	2303	STO 3	34	1401	f INT
11	02	2	35	235100	STO+0
12	00	0	36	1503	g ABS
13	236101	STOX1	37	74	R/S
14	2401	RCL 1	38	2401	RCL 1
15	234107	STO−7	39	74	R/S
16	02	2	40	02	2
17	71	/	41	71	/
18	2400	RCL 0	42	2400	RCL 0
19	1451	f x>=y	43	1451	f x>=y
20	21	x←→y	44	21	x←→y
21	2302	STO 2	45	2402	RCL 2
22	02	2	46	1451	f x>=y
23	71	/	47	21	x←→y
24	. 234107	STO−7	48	1305	GTO 05

Income Property Evaluation



BY KIMBALL BEASLEY

In this age of runaway inflation most of us are looking for a solid, reliable investment. Income property real estate investments not only hedge against inflation, but often produce income. Many potential investors who can afford an income property investment, such as a four-flat apartment building, are overwhelmed by the information processing necessary to select the right investment. Evaluating all the data, such as operating expenses, real estate taxes and rent income, plays an important part in making the right decision.

A computer, with its ability to perform rapid and accurate calculations, can be a valuable tool for the income property investor. Here is a computer program, designed for your home computer, which evaluates income property investments and helps you make the right decision. The program focuses on finding the bottom line monthly income, value of total allowable tax deductions and actual return on investment of the income property. Other considerations which may also influence decision for a long term investment may be real estate value appreciation and rate of equity buildup. Tax deduction computations are based on tax laws which are now in effect.

The common BASIC statements in the program need little or no modification for use with most home computers. The program listed was run on the Commodore PET 2001 computer with no changes other than output frills.

The program has two parts. The first part queries information on financing terms and operating expenses from the user. Total monthly expenses and mortgage payments are compared with monthly income and a monthly profit or loss (cash flow) is displayed. (This cash flow value provides a guideline for finding the best investment. Neither tax breaks nor property value appreciation do much good if you cannot keep up the monthly expenses.) The second part displays all tax-deductible expenses, such as finance costs and property depreciation, and displays an allowable income tax deduction figure.

Figure 1 – Example Investment

real estate cost	$100,000
mortgage down payment	15%
mortgage loan term	30 years
closing cost	2%
mortgage interest rate	9-1/4%
additional initial costs	0
annual real estate tax	$1500
annual heating cost	$1200
electricity cost per month	$65
insurance, water, maint. etc.	$250 per
income per month	$1300
value of land	$10,000
new or used building	used
income tax bracket	30%

Illustration by Richard A. Goldberg

Figure 2 shows a sample output that results when the apartment building financing and operating expenditures from Figure 1 are entered.

You can get this information from the seller or real estate office and lending institution.

In the sample investment a monthly cash flow of $60.72 was computed. A net operating loss allowable tax deduction of $6067.50 offering a $1820.25 tax break was also computed. The net operating loss tax deduction is the amount that may be declared as a loss incurred operating the building. Although no real loss exists (as we see by the cash flow), the government encourages an investment of this sort, making liberal tax allowances (accounted for in the program) available to the investor. The tax break is the actual dollar advantage to the investor. For the sample investment a 15% per year return on investment was calculated.

If the sample investment is re-analyzed with a 20-year mortgage term instead of 30-year, the cash flow drops

Figure 2 – Cash Flow Analysis and Tax Advantage

```
MONTHLY MORTGAGE PAYMENTS =$699.27
MONTHLY TAX PAYMENTS      =$125
MONTHLY EXPENSES          =$415

MONTHLY INCOME            =$1300

-----------------------------------------
MONTHLY CASH FLOW         =$60.72
-----------------------------------------

        INVESTMENT TAX ADVANTAGE

DEDUCTABLE INTEREST=$7862.50 FIRST YEAR
REAL ESTATE TAXES  =$1500    PER YEAR
DEPRECIATION       =$5625    FIRST YEAR
EXPENSES           =$6679.99  PER YEAR

TOTAL DEDUCTABLE=$21667.49 1ST YR
TOTAL INCOME    =$15600    PER YEAR

NET DEDUCTION   =$6067.50

-----------------------------------------
FIRST YEAR TAX BREAK =$ 1820.25
-----------------------------------------

RETURN ON INVESTMENT = 15 %
```

Figure 3 – Cash Flow Analysis and Tax Advantage

```
MONTHLY MORTGAGE PAYMENTS =$778.48
MONTHLY TAX PAYMENTS      =$125
MONTHLY EXPENSES          =$415

MONTHLY INCOME            =$1300

-----------------------------------------
MONTHLY CASH FLOW         =$-18.49
          WARNING NEGATIVE CASH FLOW
-----------------------------------------

        INVESTMENT TAX ADVANTAGE

DEDUCTABLE INTEREST=$7862.50 FIRST YEAR
REAL ESTATE TAXES  =$1500    PER YEAR
DEPRECIATION       =$5625    FIRST YEAR
EXPENSES           =$6679.99  PER YEAR

TOTAL DEDUCTABLE=$21667.49 1ST YR
TOTAL INCOME    =$15600    PER YEAR

NET DEDUCTION   =$6067.50

-----------------------------------------
FIRST YEAR TAX BREAK =$1820.25
-----------------------------------------

RETURN ON INVESTMENT = 9 %
```

Program Listing

```
10 REM************ CASH FLOW EVALUATION *********************
20 PRINT "REAL ESTATE COST";
30 INPUT C
40 PRINT "MORTGAGE DOWN PAYMENT (% OF COST)";
50 INPUT P
60 PRINT "LOAN TERM (YEARS)";
70 INPUT Y
80 PRINT "CLOSING COST- POINTS (% OF COST)";
90 INPUT F
100 PRINT "MORTGAGE INTEREST RATE (%)";
110 INPUT R
120 PRINT "ADDITIONAL INITIAL COSTS";
130 INPUT I
140 PRINT "REAL ESTATE TAX PER YEAR";
150 INPUT T
160 PRINT "HEATING COST PER YEAR";
170 INPUT H
180 PRINT "ELECTRICITY COST PER MONTH";
190 INPUT E
200 PRINT "INSURANCE, WATER, MAINT.,ETC. PER MONTH";
210 INPUT A
220 PRINT "INCOME PER MONTH";
230 INPUT Z
240 L4=C-(C*(P/100))
250 T4=1+R/1200
260 M=L4*(((R/1200)*T4**(Y*12))/((T4**(Y*12))-1))
270 PRINT"                CASH FLOW ANALYSIS"
280 PRINT
290 PRINT "MONTHLY MORTGAGE PAYMENTS =$";INT(100*M)/100
300 PRINT "MONTHLY TAX PAYMENTS      =$";INT(100*(T/12))/100
310 PRINT "MONTHLY EXPENSES          =$";INT(100*((H/12)+E+A))/100
320 PRINT
330 PRINT "MONTHLY INCOME            =$";INT(100*Z)/100
340 PRINT
350 X=(M+(T/12)+(H/12)+E+A)
360 PRINT "-------------------------------------------------"
370 PRINT "MONTHLY CASH FLOW         =$";INT(100*(Z-X))/100
380 IF Z-X<0 THEN 400
390 GO TO 410
400 PRINT "          WARNING NEGATIVE CASH FLOW"
410 PRINT "-------------------------------------------------"
420 PRINT
430 PRINT
440 PRINT
450 REM************ TAX DEDUCTION INFO *********************
460 PRINT "WANT TAX DEDUCTION INFORMATION (CONT)";
470 STOP
480 I4=L4*R/100
490 PRINT "APPROX. VALUE OF LAND";
500 INPUT V
510 PRINT "APPROX. TAX BRACKET (% OF INCOME)";
520 INPUT B4
530 PRINT "NEW (1) OR USED (2) BUILDING";
540 INPUT U
550 IF U=1 THEN 580
560 U1=1.25
570 GO TO 590
580 U1=2
590 D=U1*((C-V)/20)
600 G4=(H/12)+E+A+((F/100)*L4/12)
610 PRINT
620 PRINT
630 PRINT "            INVESTMENT TAX ADVANTAGE"
640 PRINT
650 PRINT "DEDUCTABLE INTEREST=$";INT(100*I4)/100;"FIRST YEAR"
660 PRINT "REAL ESTATE TAXES  =$";INT(100*T)/100;"PER YEAR"
670 PRINT "DEPRECIATION       =$";INT(100*D)/100;"FIRST YEAR"
680 PRINT "EXPENSES           =$";INT(100*G4*12)/100;"FIRST YEAR"
690 PRINT
700 PRINT "TOTAL DEDUCTABLE=$";INT(100*(I4+T+D+12*(G4+Z)))/100;"1ST YR"
710 PRINT "TOTAL INCOME    =$";INT(100*Z*12)/100;"PER YEAR"
720 J4=(I4+D+T+(G4*12))-Z*12
730 PRINT
740 PRINT "NET DEDUCTION   =$";INT(100*J4)/100
750 T5=J4*(B4/100)
760 PRINT
770 PRINT "-------------------------------------------------"
780 IF T5<0 THEN 810
790 PRINT "FIRST YEAR TAX BREAK =$";INT(100*T5)/100
800 GO TO 830
810 PRINT "NO TAX BREAK"
820 T5=0
830 I5=(P/100*C)+(F/100*C)+I-((Z-X)*12)
840 PRINT "-------------------------------------------------"
850 PRINT
860 PRINT
870 PRINT "RETURN ON INVESTMENT = "INT(((((Z-X)*12)+T5)/I5)*100);"%"
880 END
```

to -$18.49 per month (see Figure 3) and the program warns of a monthly cash loss. In this example a return on investment of 9% per year was found.

Altering just one financing characteristic changes the attractiveness of the investment. The program considers many factors which may be overlooked in a paper-and-pencil evaluation.

With a home computer and this program you can quickly compare several apartment buildings and select the one with the best monthly income or tax advantage (the tax advantage may be the most important information, depending on your tax bracket). The program assumes that you do not live in the building. If you as owner occupy one unit in a four-flat, your tax break would be about 3/4 of the amount displayed in the program output. □

How to write for Personal Computing

You've written the programs we want to publish. You – the *Personal Computing* readers – are using your computers in businesses, homes, offices and schools. Other readers, just as software-hungry as you, are eager to try out your programs, your applications and your techniques. So why not share what you've done by submitting an article to *PC?*

It's easier than you might think. Remember: we're more interested in practical programs and useful applications than in fancy prose. And our editorial staff stands ready to help with any problems you encounter in writing your article; just give us a call at (617) 232-5470.

Here are some handy guidelines to help you get you started.

First, decide what kind of article you want to write. Do you have a *business program* that will help an executive, salesman, doctor, lawyer or shopkeeper function more efficiently? Think about how businesses can benefit from microcomputers – not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost accounting are areas ripe for creative programming.

How do you use your computer for *home and personal applications* in your living room, kitchen, study or den? Again, think beyond the obvious areas of checkbook balancing and budgeting (though these areas are far from exhausted) to other applications. Hobbies, home management, house-hold inventory, gardening and landscaping, personal income and expense analysis, personal mailing lists and work processing are just a few ideas to spark your imagination.

What *education programs* have you written for children, adults, professionals, businessmen and teachers? Computers can not only teach children basic subjects such as spelling, math, geography, economics, civics, grammar, literature and science, but can help adults review or sharpen skills in these areas as well. How else can computers function in or out of the classroom to aid learning? To help teachers and administrators?

Are you proficient in some programming technique or special computer area you could explain in a *tutorial article*? How do you save time, money, computer memory or frustration when programming or using your computer? Others can benefit from the same techniques you use.

Computer games, history, humor and fiction are other areas rich in article and story ideas.

Your second step is to write the text of the article. Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

Third, prepare your supporting documentation. Include at least a program listing and one or two sample runs, and add program notes to explain any special commands used or other special features of your program. Use charts, diagrams, figures and photos if they help explain your program and its use.

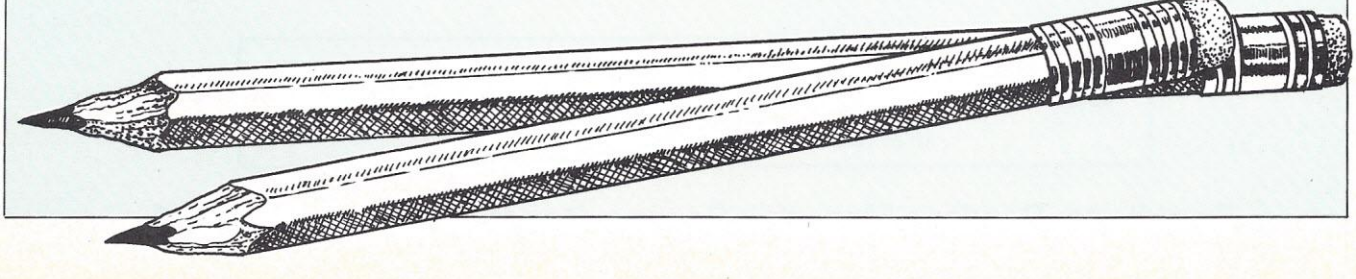
Finally, mail your manuscript. Address it to Editor, Personal Computing Magazine, 1050 Commonwealth Ave., Boston, MA 02215.

A few suggestions: All submissions should be original, typed (*not* all CAPS), double-spaced and neat. Please include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material.

Since we photograph program listings and sample runs exactly as you send them to us for publication in the magazine, please be sure you use a fresh ribbon for computer printouts. If you don't have a printer, you can type your listings single spaced; but again, be sure you use a new ribbon. (If your program relies heavily on graphics, you can photograph sample runs from your CRT. But take care to avoid distortion due to the curve of the screen.)

Feel free to call us if you have any questions or want to discuss specific ideas. We can give you feedback and suggest appropriate slants and approaches.

We're always looking for fresh, original ideas. While these guidelines will help you in preparing material for *Personal Computing*, don't assume we don't want your idea just because it's not mentioned here. Let us and our readers know what *you're* doing with your computer.



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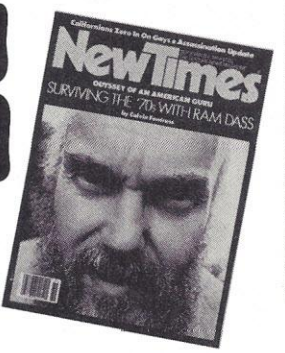

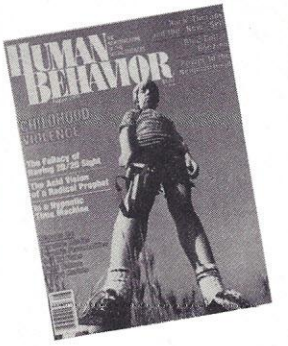

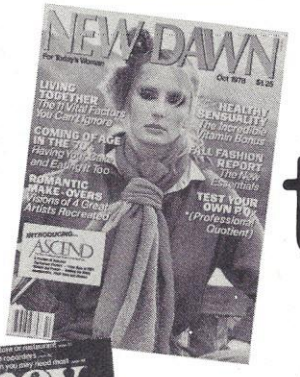

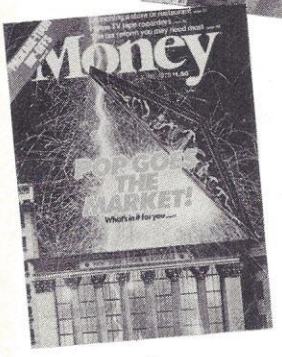

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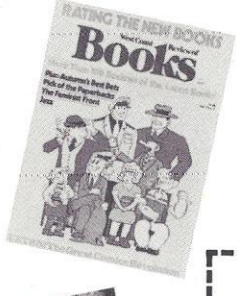

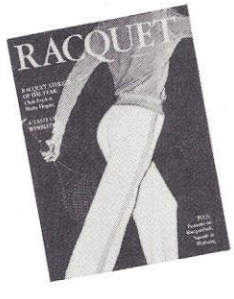

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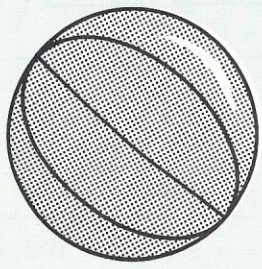
BASKETBALL MICRO-STYLE

BY JOE ROEHRIG

When you hear an announcer scream: "Erving steals the ball!" don't fall off your chair. It may only be a simulated game on your micro and, really, no need to get excited.



Want to play a computer game that needs very little input, but gives pages upon pages of output? If you do, and are interested in sports, here's the game for you. It's Pro Basketball with a micro processor. You choose the teams that will participate in the contest and you act like a coach – arranging the line-ups. The computer does all the rest and, furthermore, turns out *realistic* results based on official National Basketball Association records.

The simulation is like a mini system, because it is composed of eight programs. Don't be scared away – most of the programs are short. The memory requirement is 24K and a North Star Disk System is necessary, unless you plan to modify the material presented here. Once you have recorded the programs on a disk, then operating the system becomes a simple task. Let's assume you've entered all the programs on a diskette or were lucky enough to have a diskette with the programs.

Your first step is to load program Game, if you want to see the play-by-play action of the contest. Figure 1 shows how this program operates. The computer prompts: "How many teams for this run?" This program uses disk files and the number of teams indicates how many team files are to be used. If you enter two, only two teams can play during this particular execution. An answer of three, lets three teams play during one execution. This procedure saves wear and tear on your disk heads. The program reads necessary files only once and writes historical data to the files only after completion of the games. For example, if you enter three teams, the following could happen during one run:

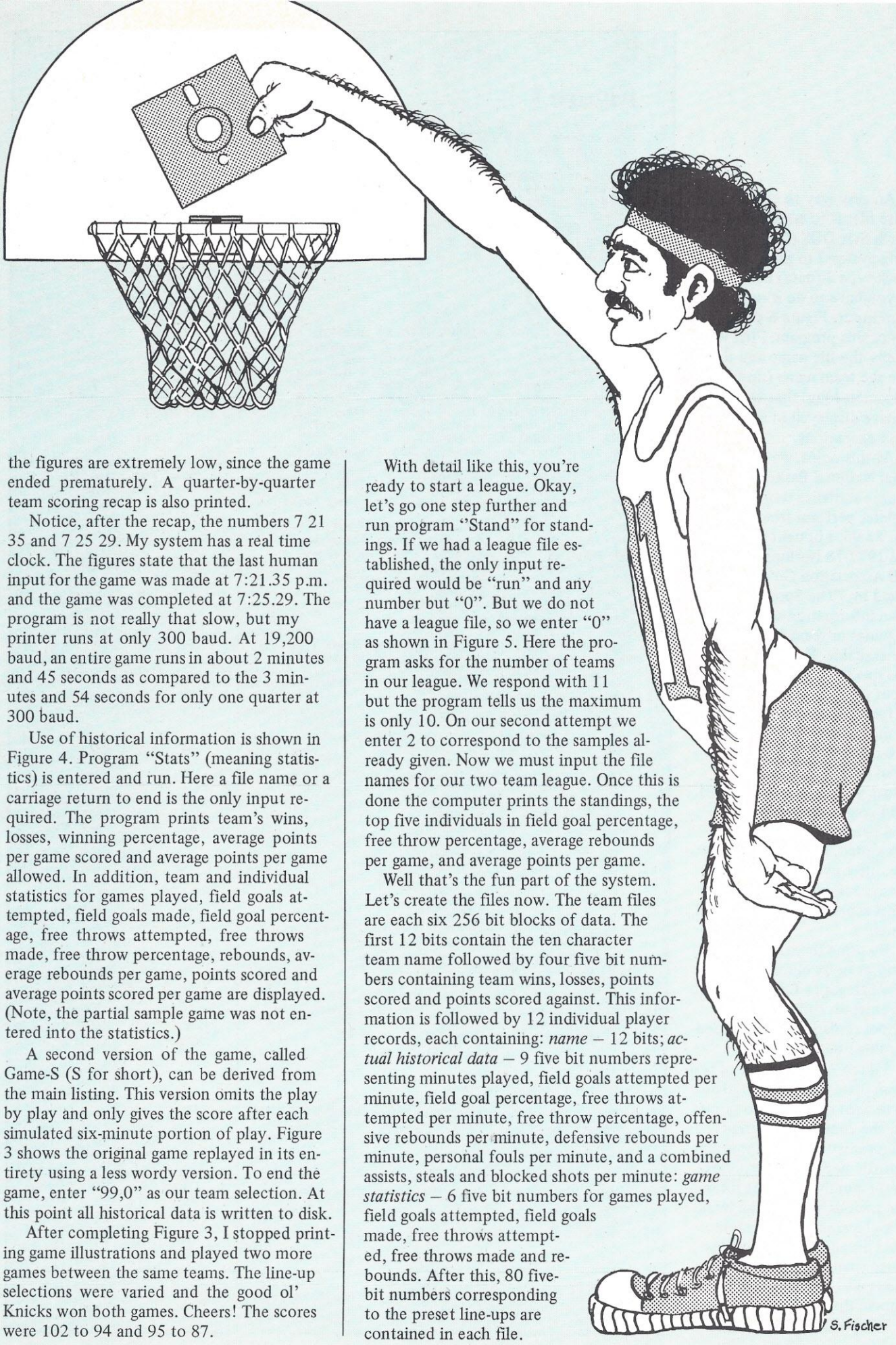
GAME #	TEAMS
1	1 plays 2
2	2 plays 3
3	1 plays 3

An entry of six teams leads to more possibilities. Naturally the same teams can play each other over and over again. Besides saving head wear, this procedure accelerates the program's execution.

Entry of more than two teams has one disadvantage – more memory is required. Figure 1 shows 10,207 bits of memory free using my 32,768 bit system. With three teams entered, only 8,938 bits are free (each extra team over two requires 1,269 additional bits). Therefore, with 24K only three teams can be entered. The program dimensions all variables after the number of teams is selected.

Next, the file names for the teams' data is entered. In the sample run, files "KNICKS" and "PHIL" were used. The computer assigns identification numbers to these files then reads the team names from the data files. As can be seen in Figure 1, team names can be different from file names. Usually, I use more basic file names to enable easier recall. The computer is now ready to let us select our teams. In the illustration this becomes a simple choice: team identification "0" plays against "1". The disk files contain two set line-ups (which we have already set and will see shortly) to choose from. After selections are made, the computer dashes off and runs the simulation. (All the inputs are edited for errors by the program.)

Instead of printing 48 minutes of play-by-play action as an illustration, my program has been edited to run 12 minutes. (The program breaks up a 48-minute official NBA game into eight six-minute units. Line 250 of program Game was changed to "FOR P = 0TO1" instead of "FOR P = 0 TO 7".) Figure 2 shows the play-by-play action and a boxscore was printed after the 12-minute game ended. The boxscore gives field goals attempted, field goals made, free throws attempted, free throws made, rebounds and points score for each player. Naturally, all of



the figures are extremely low, since the game ended prematurely. A quarter-by-quarter team scoring recap is also printed.

Notice, after the recap, the numbers 7 21 35 and 7 25 29. My system has a real time clock. The figures state that the last human input for the game was made at 7:21.35 p.m. and the game was completed at 7:25.29. The program is not really that slow, but my printer runs at only 300 baud. At 19,200 baud, an entire game runs in about 2 minutes and 45 seconds as compared to the 3 minutes and 54 seconds for only one quarter at 300 baud.

Use of historical information is shown in Figure 4. Program "Stats" (meaning statistics) is entered and run. Here a file name or a carriage return to end is the only input required. The program prints team's wins, losses, winning percentage, average points per game scored and average points per game allowed. In addition, team and individual statistics for games played, field goals attempted, field goals made, field goal percentage, free throws attempted, free throws made, free throw percentage, rebounds, average rebounds per game, points scored and average points scored per game are displayed. (Note, the partial sample game was not entered into the statistics.)

A second version of the game, called Game-S (S for short), can be derived from the main listing. This version omits the play by play and only gives the score after each simulated six-minute portion of play. Figure 3 shows the original game replayed in its entirety using a less wordy version. To end the game, enter "99,0" as our team selection. At this point all historical data is written to disk.

After completing Figure 3, I stopped printing game illustrations and played two more games between the same teams. The line-up selections were varied and the good ol' Knicks won both games. Cheers! The scores were 102 to 94 and 95 to 87.

With detail like this, you're ready to start a league. Okay, let's go one step further and run program "Stand" for standings. If we had a league file established, the only input required would be "run" and any number but "0". But we do not have a league file, so we enter "0" as shown in Figure 5. Here the program asks for the number of teams in our league. We respond with 11 but the program tells us the maximum is only 10. On our second attempt we enter 2 to correspond to the samples already given. Now we must input the file names for our two team league. Once this is done the computer prints the standings, the top five individuals in field goal percentage, free throw percentage, average rebounds per game, and average points per game.

Well that's the fun part of the system. Let's create the files now. The team files are each six 256 bit blocks of data. The first 12 bits contain the ten character team name followed by four five bit numbers containing team wins, losses, points scored and points scored against. This information is followed by 12 individual player records, each containing: *name* – 12 bits; *actual historical data* – 9 five bit numbers representing minutes played, field goals attempted per minute, field goal percentage, free throws attempted per minute, free throw percentage, offensive rebounds per minute, defensive rebounds per minute, personal fouls per minute, and a combined assists, steals and blocked shots per minute: *game statistics* – 6 five bit numbers for games played, field goals attempted, field goals made, free throws attempted, free throws made and rebounds. After this, 80 five-bit numbers corresponding to the preset line-ups are contained in each file.

An easy way to create these files is to employ the North Star DOS (Disk Operating System) to get a six block type 3 (data) file. Now, all you have to do is run program input. Figure 6 shows a run of this program. First we supply the file name and then give the team name (up to ten characters long) that we want to have displayed in all program executions.

At this point, we need official National Basketball League statistics to make our athletes perform true to life. For $3.95, I bought the Official 1977-78 National Basketball Association Guide published by "The Sporting News" as an information source. Other guides or team programs are available. Because I used this specific publication, the input program was designed to follow the published data. In the example, I used page 110 of the publication and entered J. Ervings' statistics: games played, minutes played, field goals attempted, field goal percentage, free throws attempted, free throw percentage, offensive rebounds, defensive rebounds, assists, personal fouls, steals and blocked shots.

By using these same procedures or by eliminating specific categories for all individuals entered, college or high school statistics could be used for this simulation.

Figure 7 shows a run of program roster. Here the statistics have been converted to ratings for the computer program. *Minutes* is the most important statistic here. It corresponds to the number of eight six-minute periods a player can work. If a player is used for more than his allotted periods, his performance deteriorates dramatically. Note than in this sample the line-ups are blank.

After reviewing the roster

Figure 1

```
HOW MANY TEAMS FOR THIS RUN ? 2
RANDOM NUMBER ? 5
FILE 0?KNICKS
FILE 1?PHIL
THE TEAMS NUMBERS ARE :
 0  KNICKS-----
 1  PHIL 76'ER

 10207 BITS FREE -- 99,0 TO END OR TWO TEAM NUMBERS TO PLAY A GAME ? 0,1
KNICKS----- LINEUP 1 OR 2 ? 1
PHIL 76'ER LINEUP 1 OR 2 ? 1
```

Figure 2

```
SHOT BY COLLINS---- MISSES REBOUND HAYWOOD----
SHOT BY MCADOO----- MISSES REBOUND HAYWOOD----
SHOT BY MONROE----- MISSES REBOUND JONES------
NON SHOOTING FOUL PHIL 76'ER RETAIN THE BALL
SHOT BY MCGINNIS--- MISSES REBOUND BEARD------
SHOT BY BEARD------ MISSES REBOUND BEARD------
NON SHOOTING FOUL KNICKS----- RETAIN THE BALL
SHOT BY MCMILLIAN- MISSES REBOUND COLLINS-----
SHOT BY MCGINNIS--- IS GOOD                      KNICKS----- 0 -- PHIL 76'E 2
SHOT BY HAYWOOD---- MISSES REBOUND MCMILLIAN-
SHOT BY BEARD------ IS GOOD                      KNICKS----- 2 -- PHIL 76'E 2
SHOT BY BIBBY------ IS GOOD                      KNICKS----- 2 -- PHIL 76'E 4
SHOT BY MCADOO----- IS GOOD                      KNICKS----- 4 -- PHIL 76'E 4
SHOT BY MCGINNIS--- MISSES REBOUND MCMILLIAN-
KNICKS----- LOSE THE BALL
SHOT BY COLLINS---- MISSES REBOUND BIBBY------
SHOT BY ERVING----- MISSES REBOUND HAYWOOD----
NON SHOOTING FOUL KNICKS----- RETAIN THE BALL
SHOT BY HAYWOOD---- IS GOOD                      KNICKS----- 6 -- PHIL 76'E 4
SHOT BY JONES------ MISSES REBOUND MCGINNIS---
SHOT BY ERVING----- IS GOOD                      KNICKS----- 6 -- PHIL 76'E 6
SHOT BY HAYWOOD---- IS GOOD                      KNICKS----- 8 -- PHIL 76'E 6
SHOT BY MCGINNIS--- IS GOOD                      KNICKS----- 8 -- PHIL 76'E 8
SHOT BY MCADOO----- IS GOOD                      KNICKS----- 10 -- PHIL 76'E 8
SHOT BY ERVING----- MISSES REBOUND HAYWOOD----
SHOT BY MONROE----- MISSES REBOUND MCGINNIS---
SHOT BY MCGINNIS--- IS GOOD                      KNICKS----- 10 -- PHIL 76'E 10
SHOT BY BEARD------ MISSES REBOUND MCGINNIS---
SHOT BY COLLINS---- IS GOOD                      KNICKS----- 10 -- PHIL 76'E 12
SHOT BY MCMILLIAN- IS GOOD                       KNICKS----- 12 -- PHIL 76'E 12
SHOT BY JONES------ MISSES REBOUND MCADOO-----
SHOT BY MONROE----- MISSES REBOUND MONROE-----
SHOT BY BEARD------ IS GOOD                      KNICKS----- 14 -- PHIL 76'E 12

AFTER 6 MINUTES KNICKS----- 14  --  PHIL 76'ER 12

SHOT BY JONES------ IS GOOD                      KNICKS----- 14 -- PHIL 76'E 14
SHOT BY MCADOO----- IS GOOD                      KNICKS----- 16 -- PHIL 76'E 14
SHOT BY MIX-------- IS GOOD                      KNICKS----- 16 -- PHIL 76'E 16
SHOT BY MONROE----- MISSES REBOUND JONES------
SHOT BY COLLINS---- IS GOOD                      KNICKS----- 16 -- PHIL 76'E 18
SHOT BY BEARD------ IS GOOD                      KNICKS----- 18 -- PHIL 76'E 18
SHOT BY COLLINS---- MISSES REBOUND JONES------
SHOT BY ERVING----- IS GOOD                      KNICKS----- 18 -- PHIL 76'E 20
SHOT BY BEARD------ IS GOOD                      KNICKS----- 20 -- PHIL 76'E 20
PHIL 76'ER LOSE THE BALL
NON SHOOTING FOUL KNICKS----- RETAIN THE BALL
SHOT BY MCMILLIAN- MISSES REBOUND ERVING-----
NON SHOOTING FOUL PHIL 76'ER RETAIN THE BALL
SHOT BY COLLINS---- IS GOOD                      KNICKS----- 20 -- PHIL 76'E 22
SHOT BY MONROE----- IS GOOD                      KNICKS----- 22 -- PHIL 76'E 22
NON SHOOTING FOUL PHIL 76'ER RETAIN THE BALL
SHOT BY JONES------ MISSES REBOUND MCADOO-----
SHOT BY MCADOO----- IS GOOD                      KNICKS----- 24 -- PHIL 76'E 22
FOUL ERVING------ GOES TO THE LINE FOR 2
                                                 KNICKS----- 24 -- PHIL 76'E 24
FOUL MCADOO------ GOES TO THE LINE FOR 2
                                                 KNICKS----- 26 -- PHIL 76'E 24
PHIL 76'ER LOSE THE BALL
SHOT BY MCADOO----- MISSES REBOUND ERVING------
SHOT BY COLLINS---- MISSES REBOUND JONES------
SHOT BY ERVING----- MISSES REBOUND JACKSON----
SHOT BY JACKSON---- IS GOOD                      KNICKS----- 28 -- PHIL 76'E 24
SHOT BY JONES------ IS GOOD                      KNICKS----- 28 -- PHIL 76'E 26
FOUL MCADOO------ GOES TO THE LINE FOR 2
                                                 KNICKS----- 30 -- PHIL 76'E 26
SHOT BY BIBBY------ MISSES REBOUND BIBBY------
PHIL 76'ER LOSE THE BALL
SHOT BY MCADOO----- IS GOOD                      KNICKS----- 32 -- PHIL 76'E 26
FOUL COLLINS---- GOES TO THE LINE FOR 2
                                                 KNICKS----- 32 -- PHIL 76'E 27
SHOT BY JACKSON---- MISSES REBOUND JONES------
SHOT BY BIBBY------ IS GOOD                      KNICKS----- 32 -- PHIL 76'E 29

AFTER 12 MINUTES KNICKS----- 32  --  PHIL 76'ER 29
```

Figure 2 Continued

KNICKS----- 32

NAME	FGA	FGM	FTA	FTM	REB	PTS
MCADOO-----	7	5	4	4	2	14
MONROE-----	5	1	0	0	1	2
HAYWOOD----	3	2	0	0	4	4
SHELTON----	0	0	0	0	0	0
MCMILLIAN--	3	1	0	0	2	2
CLEAMONS---	0	0	0	0	0	0
BURDEN-----	0	0	0	0	0	0
BEARD------	6	4	0	0	2	8
JACKSON----	2	1	0	0	1	2
-----------	0	0	0	0	0	0
-----------	0	0	0	0	0	0
-----------	0	0	0	0	0	0
	26	14	4	4	12	32

PHIL 76'ER 29

NAME	FGA	FGM	FTA	FTM	REB	PTS
ERVING-----	5	2	2	2	2	6
MCGINNIS---	5	3	0	0	3	6
DAWKINS----	0	0	0	0	0	0
COLLINS----	7	3	2	1	1	7
FREE-------	0	0	0	0	0	0
MIX--------	1	1	0	0	0	2
BIBBY------	3	2	0	0	2	4
DUNLEAVY---	0	0	0	0	0	0
BRYANT-----	0	0	0	0	0	0
CATCHING---	0	0	0	0	0	0
JONES-------	5	2	0	0	5	4
-----------	0	0	0	0	0	0
	26	13	4	3	13	29

TEAM	1QTR	2QTR	3QTR	4QTR	TOT.
KNICKS-----	32	0	0	0	32
PHIL 76'ER	29	0	0	0	29

```
 7 21 35
 7 25 29
THE TEAMS NUMBERS ARE :
 0  KNICKS-----
 1  PHIL 76'ER

 9927 BITS FREE -- 99,0 TO END OR TWO TEAM NUMBERS TO PLAY A GAME ? 99,0
```

Figure 3

```
AFTER 6 MINUTES KNICKS----- 14  --  PHIL 76'ER 12

AFTER 12 MINUTES KNICKS----- 32  --  PHIL 76'ER 29

AFTER 18 MINUTES KNICKS----- 48  --  PHIL 76'ER 43

AFTER 24 MINUTES KNICKS----- 68  --  PHIL 76'ER 63

AFTER 30 MINUTES KNICKS----- 83  --  PHIL 76'ER 79

AFTER 36 MINUTES KNICKS----- 96  --  PHIL 76'ER 95

AFTER 42 MINUTES KNICKS----- 110  --  PHIL 76'ER 105

AFTER 48 MINUTES KNICKS----- 125  --  PHIL 76'ER 128
```

KNICKS----- 125

NAME	FGA	FGM	FTA	FTM	REB	PTS
MCADOO-----	23	14	20	14	15	42
MONROE-----	12	4	2	2	2	10
HAYWOOD----	11	6	2	2	9	14
SHELTON----	7	3	4	2	8	8
MCMILLIAN--	5	3	2	1	2	7
CLEAMONS---	9	3	2	2	2	8
BURDEN-----	14	5	0	0	5	10
BEARD------	12	7	2	2	3	16
JACKSON----	6	5	0	0	3	10
-----------	0	0	0	0	0	0
-----------	0	0	0	0	0	0
-----------	0	0	0	0	0	0
	99	50	34	25	49	125

PHIL 76'ER 128

NAME	FGA	FGM	FTA	FTM	REB	PTS
ERVING-----	21	11	8	6	10	28
MCGINNIS---	22	10	6	4	13	24
DAWKINS----	6	4	0	0	11	8
COLLINS----	18	6	6	5	3	17
FREE-------	11	9	2	2	3	20
MIX--------	8	6	4	3	1	15
BIBBY------	9	5	0	0	3	10
DUNLEAVY---	0	0	0	0	0	0
BRYANT-----	0	0	0	0	0	0
CATCHING---	0	0	0	0	0	0
JONES-------	6	3	0	0	9	6
-----------	0	0	0	0	0	0
	101	54	26	20	53	128

TEAM	1QTR	2QTR	3QTR	4QTR	TOT.
KNICKS-----	32	36	28	29	125
PHIL 76'ER	29	34	32	33	128

```
 7 31 57
 7 35 30
THE TEAMS NUMBERS ARE :
 0  KNICKS-----
 1  PHIL 76'ER

 10178 BITS FREE -- 99,0 TO END OR TWO TEAM NUMBERS TO PLAY A GAME ?
```

print, I notice that Caldwell Jones was left off the Philadelphia roster. To correct this, program correct is loaded. This enables us to change team names, add players and insert the set line-ups. Figure 8 shows Caldwell Jones being added and the two set line-ups being entered. The set line-ups enable unlimited games to be played without requiring line-up inputs. The line-up input asks which players will play in each of the eight six-minute periods. By having two set line-ups, we can try different playing combinations against different teams without always updating the line-ups.

Okay. That is all we have to know about the files except file "League". That is a small file only one block long and program Stand formats it properly.

The next important step is to erase computer-generated statistics from our files. Program Erase does this without erasing any of the players' ratings. Figure 9 shows program Erase. The only input is the file name or a return to end the program.

Figure 10 shows what the North Star Disc file index section looks like. The first number represents the block address; the second, the size; and the third, the type (2 is program and 3 is data). Also shown in this figure are the seven changes that can be made to Game (play-by-play) to make it game-S (no play-by-play). All programs were written in North Star Basic Version 6 release 3. For Game and Game-S to work using release 3, "Line 79" must be removed from line 170.

Figure 11 details the key variables and line numbers for program Game. When you have mastered this program, the rest is easy. Good luck with your basketball cunning.

```
FILE ? PHIL

PHIL 76'ER                                                  A PTS A PTS
                                          WON LOS  PCT   FOR   AGA
                                          ===  ===  ====  =====  =====
                                            1    2 .333 103.0 107.3

NAME        #G  FGA  FGM   PCT  FTA  FTM   PCT  REB  AVE  PTS   AVE
========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== =====
ERVING----  3   53   29  .547    8    6  .750   22  7.3   64  21.3
MCGINNIS--  3   49   25  .510    8    5  .625   30 10.0   55  18.3
DAWKINS---  3   23   13  .565    0    0  .000   25  8.3   26   8.7
COLLINS---  3   44   18  .409    8    7  .875   13  4.3   43  14.3
FREE------  3   35   20  .571    8    5  .625    8  2.7   45  15.0
MIX-------  3   19   12  .632    4    3  .750    9  3.0   27   9.0
BIBBY-----  3   23   12  .522    4    2  .500    9  3.0   26   8.7
DUNLEAVY--  1    6    0  .000    0    0  .000    1  1.0    0    .0
BRYANT----  1   13    3  .231    2    1  .500    5  5.0    7   7.0
CATCHING--  1    3    2  .667    2    2 1.000    8  8.0    6   6.0
JONES-----  3   12    5  .417    0    0  .000   22  7.3   10   3.3
----------  0    0    0  .000    0    0  .000    0   .0    0    .0
========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== =====
TEAM TOTAL  3  280  139  .496   44   31  .705  152 50.7  309 103.0

FILE ? KNICKS

KNICKS----                                                  A PTS A PTS
                                          WON LOS  PCT   FOR   AGA
                                          ===  ===  ====  =====  =====
                                            2    1 .667 107.3 103.0

NAME        #G  FGA  FGM   PCT  FTA  FTM   PCT  REB  AVE  PTS   AVE
========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== =====
MCADOO----  3   67   32  .478   24   16  .667   49 16.3   80  26.7
MONROE----  3   32   17  .531    6    6 1.000    6  2.0   40  13.3
HAYWOOD---  3   39   17  .436    8    6  .750   21  7.0   40  13.3
SHELTON---  3   36   19  .528    6    4  .667   27  9.0   42  14.0
MCMILLIAN-  3   25   12  .480    2    1  .500    8  2.7   25   8.3
CLEAMONS--  3   19    7  .368    2    2 1.000   10  3.3   16   5.3
BURDEN----  3   39   15  .385    2    1  .500   10  3.3   31  10.3
BEARD-----  3   22   10  .455    2    2 1.000   12  4.0   22   7.3
JACKSON---  3   20   12  .600    2    2 1.000   14  4.7   26   8.7
----------  0    0    0  .000    0    0  .000    0   .0    0    .0
----------  0    0    0  .000    0    0  .000    0   .0    0    .0
----------  0    0    0  .000    0    0  .000    0   .0    0    .0
========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== =====
TEAM TOTAL  3  299  141  .472   54   40  .741  157 52.3  322 107.3

FILE ?

ENTER 0 TO SET OR CHANGE LEAGUE FILE ? 0
HOW MANY TEAMS IN THE LEAGUE ? 11
MAX IS 10 TEAMS
HOW MANY TEAMS IN THE LEAGUE ? 2
GIVE THE FILE NAME FOR THE 2 TEAMS IN THE LEAGUE
  1  ? KNICKS
  2  ? PHIL
```

Figure 5

```
STANDINGS
=========
                                  POINTS
TEAM          WON LOST  PCT    FOR    AGA
========== ==== ==== ==== ===== =====
KNICKS----     2    1 .667 107.3 103.0
PHIL 76'ER     1    2 .333 103.0 107.3

LEAGUE LEADERS
==============
                                                  REB                PTS
NAME         FG%  NAME         FT%  NAME         AVE  NAME         AVE
========== ====  ========== ====  ========== ====  ========== ====
CATCHING-- .667  MONROE----1.000  MCADOO----16.33  MCADOO----26.67
MIX------- .632  CLEAMONS--1.000  MCGINNIS--10.00  ERVING----21.33
JACKSON--- .600  BEARD-----1.000  SHELTON--- 9.00  MCGINNIS--18.33
FREE------ .571  JACKSON---1.000  DAWKINS--- 8.33  FREE------15.00
DAWKINS--- .565  CATCHING--1.000  CATCHING-- 8.00  COLLINS---14.33
```

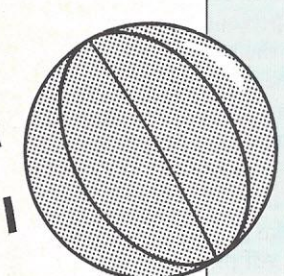


Figure 6

```
FILE ? PHIL
TEAM NAME ? PHIL 76'ERS
FOR EACH PLAYER GIVE G,MIN,FGA,%,FTA,%,OR,DR,A,PF,S,BS
PLAYER # 1  NAME ? ERVING
?82,2940,1373,.499,515,.777,192,503,306,251,159,113
PLAYER # 2  NAME ? MCGINNIS
?79,2769,1439,.458,546,.681,324,587,302,299,163,37
PLAYER # 3  NAME ? DAWKINS
?59,684,215,.628,79,.506,59,171,24,129,12,49
PLAYER # 4  NAME ? COLLINS
?58,2037,823,.518,250,.84,64,131,271,174,70,15
```

Figure 6 Continued

```
PLAYER # 5  NAME ? FREE
?78,2253,1022,.457,464,.72,97,140,266,207,75,25
PLAYER # 6  NAME ? MIX
?75,1958,551,.523,263,.817,127,249,152,167,90,20
PLAYER # 7  NAME ? BIBBY
?81,2639,702,.43,282,.784,86,187,356,200,108,5
PLAYER # 8  NAME ? DUNLEAVY
?32,359,145,.414,45,.756,10,24,56,64,13,2
PLAYER # 9  NAME ? BRYANT
?61,612,240,.446,70,.757,45,72,48,84,36,13
PLAYER # 10  NAME ? CATCHINGS
?53,864,6_123,.504,47,.702,64,170,30,130,23,78
PLAYER # 11  NAME ?
?1,1,0,0,0,0,0,0,0,0,0,0
PLAYER # 12  NAME ?
?1,1,0,0,0,0,0,0,0,0,0,0
```

Figure 7

```
FILE ? PHIL
ROSTER FOR PHIL 76'ER
=====================
 # NAME          MIN   FGA   PCT   FTA   PCT O REB D REB    PF   DEF
 1 ERVING----  6.00 46.70  .50  8.76  .78  6.53 17.11  7.26  9.25
 2 MCGINNIS--  6.00 51.97  .46  9.86  .68 11.70 21.20  9.18  7.22
 3 DAWKINS---  4.00 31.43  .63  5.77  .51  8.63 25.00 16.03  3.86
 4 COLLINS---  6.00 40.40  .52  6.14  .84  3.14  6.43  7.26  4.17
 5 FREE------  5.00 45.36  .46 10.30  .72  4.31  6.21  7.81  4.44
 6 MIX-------  4.00 28.14  .52  6.72  .82  6.49 12.72  7.25  5.62
 7 BIBBY-----  5.00 26.60  .43  5.34  .78  3.26  7.09  6.44  4.28
 8 DUNLEAVY--  4.00 40.39  .41  6.27  .76  2.79  6.69 15.15  4.18
 9 BRYANT----  4.00 39.22  .45  5.72  .76  7.35 11.76 11.67  8.01
10 CATCHING--  4.00 14.24  .50  2.72  .70  7.41 19.68 12.79 11.69
11 ----------  4.00   .00  .00   .00  .00   .00   .00   .00   .00
12 ----------  4.00   .00  .00   .00  .00   .00   .00   .00   .00
LINEUP #1                                LINEUP #2
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
    0    0    0    0    0                   0    0    0    0    0
```

Figure 8

```
FILE ? PHIL
0-END 1-TEAM NAME 2-PLAYER 3-LINEUP ? 2
FOR EACH PLAYER GIVE G,MIN,FGA,%,FTA,%,OR,DR,A,PF,S,BS
#,PLAYER'S NAME OR 0, TO RETURN ? 11,JONES
?82,2023,424,.507,116,.552,190,476,92,301,43,200
#,PLAYER'S NAME OR 0, TO RETURN ? 0,
0-END 1-TEAM NAME 2-PLAYER 3-LINEUP ? 3
LINEUP 1 OR 2 ? 1
THIS IS LINEUP 1 OF 2
PEROID 1
5 PLAYERS ? 1,2,11,4,7
PEROID 2
5 PLAYERS ? 1,6,11,4,7
PEROID 3
5 PLAYERS ? 1,2,3,4,5
PEROID 4
5 PLAYERS ? 6,2,3,4,5
PEROID 5
5 PLAYERS ? 1,2,3,5,7
PEROID 6
5 PLAYERS ? 6,2,3,5,7
PEROID 7
5 PLAYERS ? 1,6,11,4,5
PEROID 8
5 PLAYERS ? 1,2,11,4,7
0-END 1-TEAM NAME 2-PLAYER 3-LINEUP ? 3
LINEUP 1 OR 2 ? 2
THIS IS LINEUP 2 OF 2
PEROID 1
5 PLAYERS ? 1,2,11,4,7
PEROID 2
5 PLAYERS ? 1,9,10,4,7
PEROID 3
5 PLAYERS ? 9,2,10,4,5
PEROID 4
5 PLAYERS ? 6,9,3,4,5
PEROID 5
5 PLAYERS ? 1,2,,_3,5,7
PEROID 6
5 PLAYERS ? 1,6,10,4,8
PEROID 7
5 PLAYERS ? 6,2,3,5,8
PEROID 8
5 PLAYERS ? 1,2,11,8,7
0-END 1-TEAM NAME 2-PLAYER 3-LINEUP ? 0
```

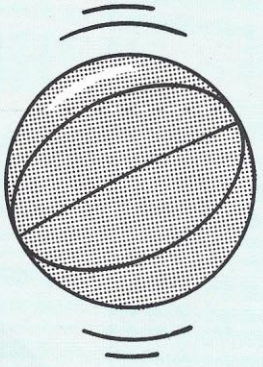
Figure 9

```
FILE TO BE ERASED ? PHIL
FILE TO BE ERASED ? KNICKS
FILE TO BE ERASED ?
```

Figure 10

```
LI
GAME       4  20   2
INPUT     24   4   2
CORRECT   28   6   2
ROSTER    34   4   2
STATS     38   7   2
ERASE     45   2   2
STAND     47  10   2
LEAGUE    57   1   3
KNICKS    78   6   3
PHIL      84   6   3
GAME-S    58  20   2
*
```

```
 305 C1=FNA(A)
315
365 C1=FNA(A)
482 C1=FNA(A):GOTO490
484 GOTO488
486 REM
850 RETURN
```



Input

```
10 N$="------------"\INPUT"FILE ? ",F$\OPEN#0,F$
20 INPUT"TEAM NAME ? ",M$\M$=M$+N$\WRITE#0,M$,Z,Z,Z,Z
30 !"FOR EACH PLAYER GIVE G,MIN,FGA,%,FTA,%,OR,DR,A,PF,S,BS"
35 FORA=1TO12\!"PLAYER #",A,\INPUT"  NAME ? ",M$
40 M$=M$+N$
45 INPUTA1,A2,A3,A4,A5,A6,A7,A8,B1,A9,B1,B2
50 R1=A2/A1+3\IFR1<24THENR1=24\R1=INT(R1/6)
55 A2=A2/100
60 R2=A3/A2\R4=(A5/A2)*.5\R6=A7/A2\R7=A8/A2\R8=A9/A2*.85
70 R9=(B1+B2+B3)/A2
80 WRITE#0,M$,R1,R2,A4,R4,A6,R6,R7,R8,R9,Z,Z,Z,Z,Z,Z\NEXT
90 R1=0\R2=0\R3=0\R4=0\R5=0\FORA=1TO2\FORB=1TO8
110 WRITE#0,R1,R2,R3,R4,R5\NEXT\NEXT
```

Correct

```
10 N$="------------"\INPUT"FILE ? ",F$\OPEN#0,F$
12 INPUT"0-END 1-TEAM NAME 2-PLAYER 3-LINEUP ? ",A\IFA<1THENEND
14 IFA>3THENEND\ONAGOTO20,30,90
20 INPUT"TEAM NAME ? ",M$\M$=M$+N$\WRITE#0,M$,NOENDMARK\GOTO12
30 !"FOR EACH PLAYER GIVE G,MIN,FGA,%,FTA,%,OR,DR,A,PF,S,BS"
35 INPUT"#,PLAYER'S NAME OR 0, TO RETURN ? ",A,M$
36 IFA=0THEN12
37 IFA<1THEN12\IFA>12THEN35
40 M$=M$+N$
42 Q=32+((A-1)*87)
45 INPUTA1,A2,A3,A4,A5,A6,A7,A8,B1,A9,B1,B2
50 R1=A2/A1+3\IFR1<24THENR1=24\R1=INT(R1/6)
55 A2=A2/100
60 R2=A3/A2\R4=(A5/A2)*.5\R6=A7/A2\R7=A8/A2\R8=A9/A2*.85
70 R9=(B1+B2+B3)/A2
80 WRITE#0%Q,M$,R1,R2,A4,R4,A6,R6,R7,R8,R9,NOENDMARK\GOTO35
90 INPUT"LINEUP 1 OR 2 ? ",A\IFA=1THENA=0\IFA<>0THENA=1
92 Q=1076+(A*200)
95 !"THIS IS LINEUP",A+1," OF 2"
100 FORB=1TO8\!"PEROID",B\INPUT"5 PLAYERS ? ",R1,R2,R3,R4,R5
110 W=Q+((B-1)*25)\WRITE#0%W,R1,R2,R3,R4,R5,NOENDMARK
120 NEXT\GOTO12
```

Roster

```
5 LINE 80\DIML(1,7,4)
10 INPUT"FILE ? ",F$\OPEN#0,F$
20 READ #0,F$,Z,Z,Z,Z
30 !"ROSTER FOR ",F$\!"======================"
40 !" # NAME          MIN   FGA   PCT   FTA   PCT O REB D REB    PF   DEF"
60 FOR A=1TO12\READ#0,F$,R1,R2,R3,R4,R5,R6,R7,R8,R9,Z,Z,Z,Z,Z,Z
70 !%2I,A," ",F$,%6F2,R1,R2,R3,R4,R5,R6,R7,R8,R9\NEXT
80 FORA=0TO1\FORB=0TO7
85 READ#0,L(A,B,0),L(A,B,1),L(A,B,2),L(A,B,3),L(A,B,4)\NEXT\NEXT
90     !"LINEUP #1",TAB(40),"LINEUP #2"\FORB=0TO7
92 !%5I,L(0,B,0),L(0,B,1),L(0,B,2),L(0,B,3),L(0,B,4),TAB(40),
94 !%5I,L(1,B,0),L(1,B,1),L(1,B,2),L(1,B,3),L(1,B,4)\NEXT
```

State

```
20 INPUT"FILE ? ",F$\IFF$=""THENEND\OPEN#0,F$\LINE79
30 READ#0,N$,A1,A2,A3,A4\A5=A1+A2\!""
35 IFA5<>0THEN40\!"NO STATS ON THAT FILE"\CLOSE#0\GOTO20
40 !N$,TAB(40),"              A PTS A PTS"\A9=A5
50 !TAB(40),"WON LOS  PCT  FOR   AGA"
55 !TAB(40),"=== === ===== ===== ====="\A6=A1/A5
57 A3=A3/A5\A4=A4/A5\!TAB(39),%4I,A1,A2,%5F3,A6,%6F1,A3,A4\!" "
60 !"NAME       #G  FGA  FGM   PCT  FTA  FTM   PCT  REB  AVE  PTS   AVE"
70 !"========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== ====="
100 FORA=1TO12\READ#0,N$,A1,A1,A1,A1,A1,A1,A1,A1,A1
110 READ#0,A1,A2,A3,A4,A5,A6
115 T6=T6+A6\T2=A2+T2\T3=A3+T3\T4=T4+A4\T5=T5+A5
117 B1=0\B2=0\B3=0\B4=0\B5=0
120 IFA1=0THEN140\IFA2=0THEN125\B1=A3/A2
125 IFA4=0THEN130\B2=A5/A4
130 B3=A6/A1\B4=2*A3+A5\B5=B4/A1
140 !N$,%3I,A1,%5I,A2,A3,%6F3,B1,%5I,A4,A5,%6F3,B2,%5I,A6,%5F1,B3,
150 !%5I,B4,%6F1,B5\NEXT
160!"========== == ==== ==== ===== ==== ==== ===== ==== ==== ==== ====="
170 A1=A9\A2=T2\A3=T3\A4=T4\A5=T5\T1=0\T2=0\T3=0\T4=0\T5=0\A6=T6\T6=0
180 IFA1=0THEN20
190 B1=A3/A2\B2=A5/A4\B3=A6/A1\B4=2*A3+A5\B5=B4/A1
200 N$="TEAM TOTAL"\CLOSE#0
210 !N$,%3I,A1,%5I,A2,A3,%6F3,B1,%5I,A4,A5,%6F3,B2,%5I,A6,%5F1,B3,
220 !%5I,B4,%6F1,B5\!""\GOTO20
```

Erase

```
10 INPUT"FILE TO BE ERASED ? ",F$\IFF$=""THENEND
20 OPEN#0,F$\C=12\WRITE#0%C,A,A,A,A,NOENDMARK
30 FORB=0TO11\C=(B*87)+89
40 WRITE#0%C,A,A,A,A,A,A,NOENDMARK
50 NEXT\CLOSE#0\GOTO10
```

Figure 11 Key Variables

(Dimension zero is always utilized)

A(1,6) – 2 teams playing,
7 work space variables to calculate team ratings

P(1,3) – 2 teams
4 actions codes – 0 = a shot; 1 = player gets fouled; 2 = lost ball; 3 = rebound rating.

S(C,11,15) – C number of teams in run
12 players
16 ratings (note lines 130, 140, and 142 mix the ratings variable indexes so that they do not conform to the file structure. This makes some of the recordkeeping easier)
0 field goals attempted (second file variable)
1 fouls committed (eighth file variable)
2 defensive ability (ninth file variable)
3 free throws attempted (fourth file variable)
4 offensive rebounds (sixth file variable)
5 defensive rebounds (seventh file variable)
6 free throw percentage (fifth file variable)
7 periods a player should play (first file variable)
8 field goal percentage (third file variable)
9 games played
10 field goals attempted
11 field goals made
12 free throws attempted
13 free throws made
14 rebounds
15 work variable to register when a player played the maximum number of periods

L(B,7,4) – B number of teams in run doubled
8 line-ups for each six minute period
5 players playing in the period

T(C,3) – C number of teams in run
4 team statistics – 0 wins; 1 losses; 2 points scored; 3 points scored against.

T$(D) – team names

P$(E) – player names

Q(1,3) – 2 teams
4 points by quarter

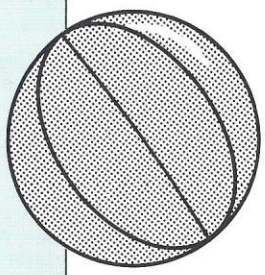
G(1,12,4) – 2 teams
12 players and team totals
5 statistics for game in progress – 0 field goals attempted; 1 field goals; 2 free throws attempted; 3 free throws; 4 rebounds.

Line Numbers

3-25 Dimension variables
30 Set random number
100-170 Read files
171-245 Select teams and line-ups
250-500 Play game
502-508 Update team statistics
510-596 Print box score
600-620 Zero variables for new game
750 Update player statistics
800-810 Determine player shooting or rebounding
850 Print score for play by play
900-949 Calculate ratings for play
999-1000 Print lines
1100-1140 Write historical data to files
9857-9858 Real time clock (this and line 596 can be deleted)

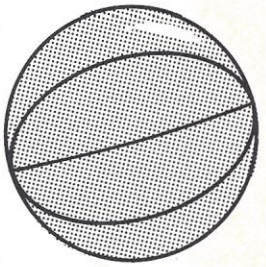
Program Listing

```
3 INPUT"HOW MANY TEAMS FOR THIS RUN ? ",T
4 IFT>1THEN5\!"YOU NEED TWO TEAMS"\GOTO3
5 B=T*2-1\C=T-1\D=T*10\E=T*120\T=T-1\Z$="----------"
10 DIMA(1,6),P(1,3),S(C,11,15),L(B,7,4),T(C,3),T$(D),P$(E),L2(1),F$(D)
20 DIML1(1),W(1,4,2),R(1,3,3),I(1,4),S1(1),G(1,12,4),Q(1,3),F(1)
25 DEFFNA(A)=(L2(A)*120)+(S*10)+1
30 INPUT"RANDOM NUMBER ? ",A\FORB=1TOA\C=RND(0)\NEXT
100 FORA=0TOT\!"FILE",A,\INPUTZ$\OPEN#0,Z$\B=(A*10)+1
105 F$(B,B+9)=Z$
110 READ#0,T$(B,B+9),T(A,0),T(A,1),T(A,2),T(A,3)
120 FORB=0TO11\C=(120*A)+(B*10)+1
130 READ#0,P$(C,C+9),S(A,B,7),S(A,B,0),S(A,B,8),S(A,B,3),S(A,B,6),S(A,B,4)
```



Program Listing Continued

```
140 READ#0,S(A,B,5),S(A,B,1),S(A,B,2),S(A,B,9),S(A,B,10),S(A,B,11),S(A,B,12)
142 READ#0,S(A,B,13),S(A,B,14)\NEXT
150 FORB=0TO1\C=B+(A*2)\FORD=0TO7
160 READ#0,L(C,D,0),L(C,D,1),L(C,D,2),L(C,D,3),L(C,D,4)
170 NEXT\NEXT\CLOSE#0\NEXT\LINE79
171 !"THE TEAMS NUMBERS ARE : "
172 FORA=0TOT\B=10*A+1\!%2I,A,"  ",T$(B,B+9)\NEXT
200 INPUT"99,0 TO END OR TWO TEAM NUMBERS TO PLAY A GAME ? ",L2(0),L2(1)
202 IFL2(0)=99THEN1100
205 IFT<L2(0)ORT<L2(1)THEN200\IFL2(0)<00RL2(1)<0THEN200
207 FORA=0TO1\B=L2(A)*10+1\!T$(B,B+9),\INPUT" LINEUP 1 OR 2 ? ",L1(A)
208 IFL1(A)=1ORL1(A)=2THEN209\INPUT"LINEUP ? ",L1(A)\GOTO208
209 K1=B\IFA=0THENK=B\NEXT\C8=K\C9=K1
210 GOSUB9857\U4=U1\U5=U2\U6=U3
240 A=0\IFRND(0)>.5THENA=1\D=1\IFA=1THEND=0\V=L1(A)
245 IFA=0THEN250\K2=K\K=K1\K1=K2
250 FORP=0TO7\GOSUB900\C=32\Q=INT(P/2)\IFP<>(2*Q)THEN255
252 F(0)=0\F(1)=0
255 FORB=0TOC\E=RND(0)
260 IFP(A,0)>ETHEN300
270 IFP(A,1)>ETHEN350\GOTO484
300 G=A\F=0\GOSUB800\G(A,S,0)=G(A,S,0)+1\H=RND(0)
305 C1=FNA(A)\!"SHOT BY ",P$(C1,C1+9),
310 IFRND(0)>S(V,S,8)THEN400
315 !" IS GOOD",
320 S1(A)=S1(A)+2\G(A,S,1)=G(A,S,1)+1
325 GOSUB850
330 GOTO488
350 F(A)=F(A)+1\IFF(A)<4THEN486
360 G=A\F=1\GOSUB800\G(A,S,2)=G(A,S,2)+2
365 C1=FNA(A)\!"FOUL ",F$(C1,C1+9)," GOES TO THE LINE FOR 2"
370 GOSUB390\GOSUB390
375 GOSUB850
380 IFZ=1THEN400\GOTO488
390 Z=1\H=RND(0)\IFH>S(V,S,6)THENRETURN
395 G(A,S,3)=G(A,S,3)+1\S1(A)=S1(A)+1\Z=0\RETURN
400 IFRND(0)>P(A,3)THEN460
410 G=A\F=2\GOSUB800\G(A,S,4)=G(A,S,4)+1\GOTO482
460 G=D\F=3\GOSUB800\G(D,S,4)=G(D,S,4)+1
480 E=A\A=D\D=E\V=A\K2=K1\K1=K\K=K2
482 C1=FNA(A)\!" MISSES REBOUND ",P$(C1,C1+9)\GOTO490
484 !T$(K,K+9)," LOSE THE BALL"\GOTO488
486 !"NON SHOOTING FOUL ",T$(K ,K +9)," RETAIN THE BALL"
487 GOTO490
488 E=A\A=D\D=E\V=A\K2=K1\K1=K\K=K2
489 K=C8\IFA=1THENK=C9
490 NEXT
492 FORS=0TO1\Q(S,Q)=S1(S)-Q(S,0)-Q(S,1)-Q(S,2)-Q(S,3)+Q(S,Q)\NEXT
494 IFS1(0)<>S1(1)ORP<7THEN497
496 C=15\GOTO255
497 !" "
498 C1=6*P+6\!"AFTER",C1," MINUTES ",T$(C8,C8+9),S1(0),
499 !"  --  ",T$(C9,C9+9),S1(1)\!""\NEXT
500 !T$(C8,C8+9),S1(0),TAB(40),T$(C9,C9+9),S1(1)\!" "
502 B=L2(0)\T(B,2)=T(B,2)+S1(0)\T(B,3)=T(B,3)+S1(1)\T(B,0)=T(B,0)+1
504 IFS1(0)>S1(1)THEN506\T(B,0)=T(B,0)-1\T(B,1)=T(B,1)+1
506 B=L2(1)\T(B,2)=T(B,2)+S1(1)\T(B,3)=T(B,3)+S1(0)\T(B,0)=T(B,0)+1
508 IFS1(1)>S1(0)THEN510\T(B,0)=T(B,0)-1\T(B,1)=T(B,1)+1
510 !"NAME        FGA FGM FTA FTM REB PTS",TAB(40),
520 !"NAME        FGA FGM FTA FTM REB PTS"
525 GOSUB999
530 FORB=0TO11\FORA=0TO1\C=A\IFA=1THENC=40\GOSUB750
540 E=(2*G(A,B,1))+G(A,B,3)\D=(B*10)+1
550 D=(L2(A)*120)+(B*10)+1
560 !TAB(C),P$(D,D+9),%4I,G(A,B,0),G(A,B,1),G(A,B,2),G(A,B,3),G(A,B,4),
562 FORH=0TO4\G(A,12,H)=G(A,12,H)+G(A,B,H)\NEXT
570 !%4I,E,\IFA=1THEN!""\NEXT\NEXT
572 A=(2*G(0,12,1))+G(0,12,3)\B=(2*G(1,12,1))+G(1,12,3)\GOSUB999
574 !TAB(10),%4I,G(0,12,0),G(0,12,1),G(0,12,2),G(0,12,3),G(0,12,4),A,
576 !TAB(50),%4I,G(1,12,0),G(1,12,1),G(1,12,2),G(1,12,3),G(1,12,4),B
580 !""\!"TEAM        1QTR 2QTR 3QTR 4QTR TOT."
590 !"========================================"
591 A=C8+9\B=C9+9
592 !T$(C8,A),%5I,Q(0,0),Q(0,1),Q(0,2),Q(0,3),S1(0)
594 !T$( C9,B),%5I,Q(1,0),Q(1,1),Q(1,2),Q(1,3),S1(1)
595 !""\INPUT"READY ? ",Z$
600 FORA=0TO1\S1(A)=0\FORB=0TO4\IFB=4THEN610\Q(A,B)=0
610 FORC=0TO12\G(A,C,B)=0\NEXT\NEXT\NEXT
615 FORU=0TO1
620 A=L2(U)   \FORB=0TO11\S(A,B,15)=0\NEXT\NEXT\GOTO172
750 S1=L2(A)\FORS=0TO4\S(S1,B,S+10)=S(S1,B,S+10)+G(A,B,S)\NEXT\RETURN
800 H=RND(0)\FORS=0TO3\IFR(G,S,F)>HTHENEXIT810\NEXT\S=4
810 S=I(G,S)\RETURN
850 !TAB(45),T$(C8,C8+9),S1(0)," -- ",T$(C9,C9+8),S1(1)\RETURN
900 FORS=0TO1\FORS1=0TO6\A(S,S1)=0\NEXT\NEXT
910 FORS=0TO1\U=L2(S)\S1=L1(S)+(2*U)-1\FORS2=0TO4\S3=L(S1,P,S2)-1\X=1
915 S(U,S3,15)=S(U,S3,15)+1\IFS(U,S3,15)>S(U,S3,7)THENX=.5
917 IFS(U,S3,15)=1THENS(U,S3,9)=S(U,S3,9)+1
```



```
920 FORS4=0TO5\A(S,S4)=A(S,S4)+(X*S(U,S3,S4))\NEXT\A(S,6)=A(S,1)*.2
925 I(S,S2)=S3
930 NEXT\A(S,1)=A(S,1)*.8\NEXT
932 P(0,2)=A(0,0)+A(1,1)+A(1,2)+A(0,6)
934 P(1,2)=A(1,0)+A(0,1)+A(0,2)+A(1,6)
936 FORS=0TO1\S1=1\IFS=1THENS1=0
938 P(S,0)=A(S,0)/P(S,2)\P(S,1)=(A(S1,1)+A(S,0))/P(S,2)
939 P(S,2)=(A(S,0)+A(S1,1)+A(S1,2))/P(S,2)\NEXT
940 P(0,3)=A(0,4)/(A(0,4)+A(1,5))
942 P(1,3)=A(1,4)/(A(1,4)+A(0,5))
944 FORS=0TO1\U=L2(S)\FORS1=2TO5\S2=S1\IFS1=2THENS2=0\S5=S1-2
946 FORS3=0TO3\S4=I(S,S3)\R(S,S3,S5)=S(U,S4,S2)/A(S,S2)
947 IFS3>0THENR(S,S3,S5)=R(S,S3,S5)+R(S,S3-1,S5)
948 NEXT\NEXT\NEXT
949 RETURN
999 !"=======================================  ",
1000 !"==========================================="\RETURN
1100 FORA=0TO7\B=A*10+1\C=12\OPEN#0,F$(B,B+9)
1110 WRITE#0%C,T(A,0),T(A,1),T(A,2),T(A,3),NOENDMARK
1120 FORB=0TO11\C=(B*87)+89
1130 WRITE#0%C,S(A,B,9),S(A,B,10),S(A,B,11),S(A,B,12)
1140 WRITE#0,S(A,B,13),S(A,B,14),NOENDMARK\NEXT\CLOSE#0\NEXT\END
9857 FORU=0TO7\U(U)=INP(168+U)\NEXT\U1=10*U(7)+U(6)
9858 U2=10*U(5)+U(1)\U3=10*U(2)+U(3)\RETURN
```

Program Listing Condensed

```
10 DIMN$(100),P$(200),L(4,5),T(10,6),T$(100)
20 FORA=10TO100STEP10\N$(A-9,A)="----------"\NEXT
25 T$=N$\P$=T$+N$
30 OPEN#0,"LEAGUE"
40 INPUT"ENTER 0 TO SET OR CHANGE LEAGUE FILE ? ",A\IFA<>0THEN300
50 INPUT"HOW MANY TEAMS IN THE LEAGUE ? ",A
55 IFA>0ANDA<11THEN60\!"MAX IS 10 TEAMS"\GOTO50
60 !"GIVE THE FILE NAME FOR THE",A," TEAMS IN THE LEAGUE"
70 FORB=1TOA\C=B*10\!%3I,B,
75 F$="----------"
80 INPUT"   ? ",F$\N$(C-9,C)=F$\NEXT
90 WRITE#0,A,N$\GOTO310
300 READ#0,A,N$
310 CLOSE#0
315 A1=A
320 FORB=1TOA\C=10*B\F$=N$(C-9,C)\FORC=10TO1STEP-1
330 IFF$(C,C)<>"-"THENEXIT350
340 F$(C,C)=" "\NEXT
350 OPEN#0,F$
360 READ#0,T$(B*10-9,B*10),T(B,1),T(B,2),T(B,3),T(B,4)
361 T(B,0)=B\T(B,5)=T(B,1)+T(B,2)
364 IFT(B,5)=0THEN365\T(B,6)=T(B,1)/T(B,5)
365 FORV=1TO12
370 READ#0,F$,E,E,E,E,E,E,E,E,E,E1,E2,E3,E4,E5,E6
372 IFE1=0THENE1=999999\IFE2=0THENE2=999999\IFE4=0THENE4=999999
380 E(1)=E3/E2\E(2)=E5/E4\E(3)=E6/E1\E(4)=((2*E3)+E5)/E1
390 FORF=1TO4\FORG=1TO5\IFL(F,G)>=E(F)THEN500
395 I=(F-1)*50
400 FORH=4TOGSTEP-1\L(F,H+1)=L(F,H)
410 J=((H+1)*10)+I\P$(J-9,J)=P$(J-19,J-10)\NEXT
415 I=I+(10*G)\P$(I-9,I)=F$\L(F,G)=E(F)
420 EXIT 510
490 CLOSE#0
500 NEXT
510 NEXT\NEXT\CLOSE#0\NEXT
600 B=0\FORA=1TOA1-1\C=T(A,0)\C1=T(A+1,0)
610 IFT(C,6)>T(C1,6)THEN630
620 B=1\T(A,0)=C1\T(A+1,0)=C
630 NEXT\IFB<>0THEN600
650 !""\!"STANDINGS"\!"==========="
655 !"                          POINTS"
660 !"TEAM         WON LOST  PCT   FOR   AGA"
670 !"=========== ==== ==== ==== ===== ====="
680 FORA=1TOA1\B=T(A,0)\C=10*B
690 !T$(C-9,C),%5I,T(B,1),T(B,2),%5F3,T(B,6),
692 !%6F1,T(B,3)/T(B,5),T(B,4)/T(B,5)\NEXT
750 !""\!"  "
800 !"LEAGUE LEADERS"
802 !"================"
804 !"                                                REB             PTS"
810 !"NAME         FG%  NAME         FT%  NAME        AVE  NAME       AVE"
820 !"=========== ====  ========== ====  ========== ====  ========= ====="
830 FORC=1TO5\FORA=1TO4\B=(50*(A-1))+(C*10)
840 !P$(B-9,B),\IFA>2THEN860
850 !%5F3,L(A,C),"  ",\GOTO870
860 !%5F2,L(A,C),"  ",
870 NEXT\!" "\NEXT
880 !""\!" "\END
READY
```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CIRCLE 6

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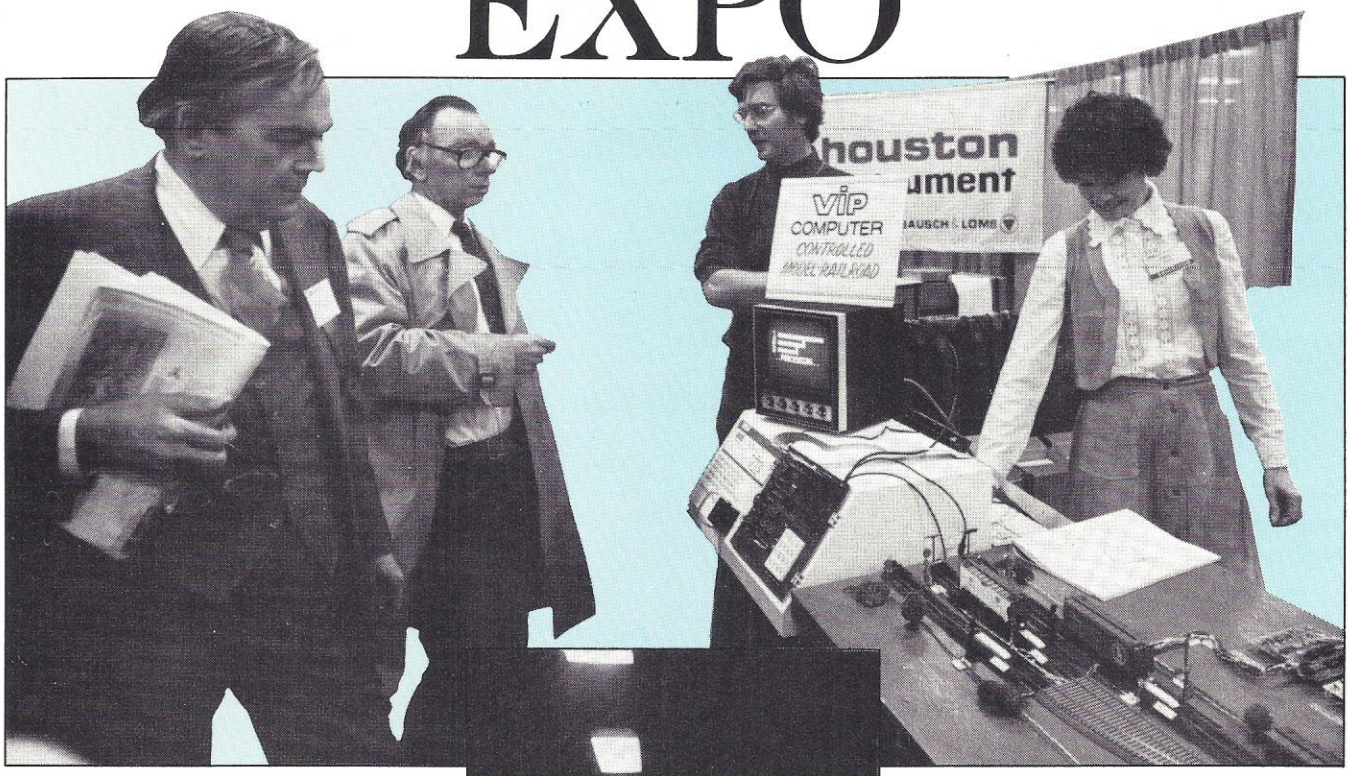
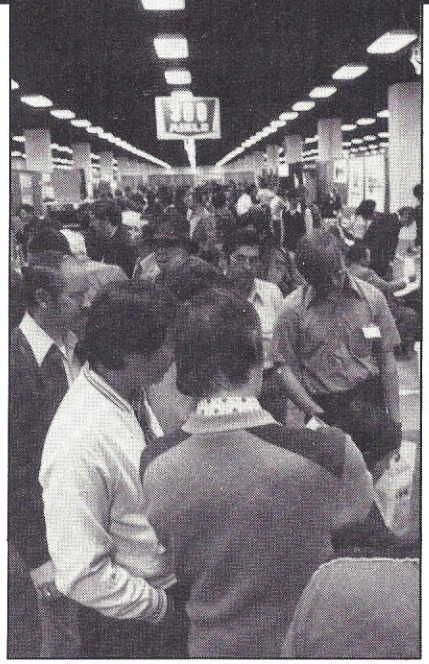


Terry Laudereau (R) and RCA's Richard Simpson

Experts and novices, businessmen and school kids, curious on-lookers and serious buyers made a steady stream through Chicago's Expocenter during the Second Annual Midwest Personal Computing Exposition last October. Over 10,000 people attended the four-day event, listening to seminars, viewing exhibits, trying out equipment and picking up take-home literature on systems, components, peripherals and software.

Exhibitors were pleased with the show's high-quality crowd, composed largely of businessmen and other potential buyers. And the attendees were delighted with the chance to see and try out the latest microcomputer technology.

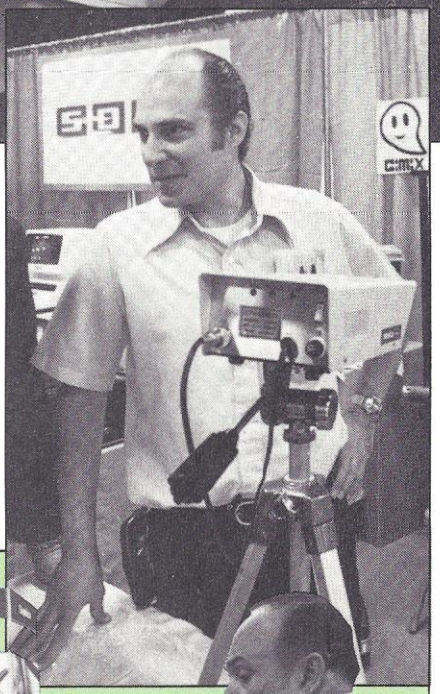
Several business-oriented systems were on display at the show. Alpha Micro, for example, offered their Alpha Accounting Package. This system includes General Ledger, Accounts Receivable, Accounts Payable, Order Entry/Inventory Control and Payroll, plus various business subroutines. Alpha Micro hardware includes CPU board, floppy disk controller board, I/O board and hard disk controller – not a complete computer system, but compatible with other components needed to build a system.



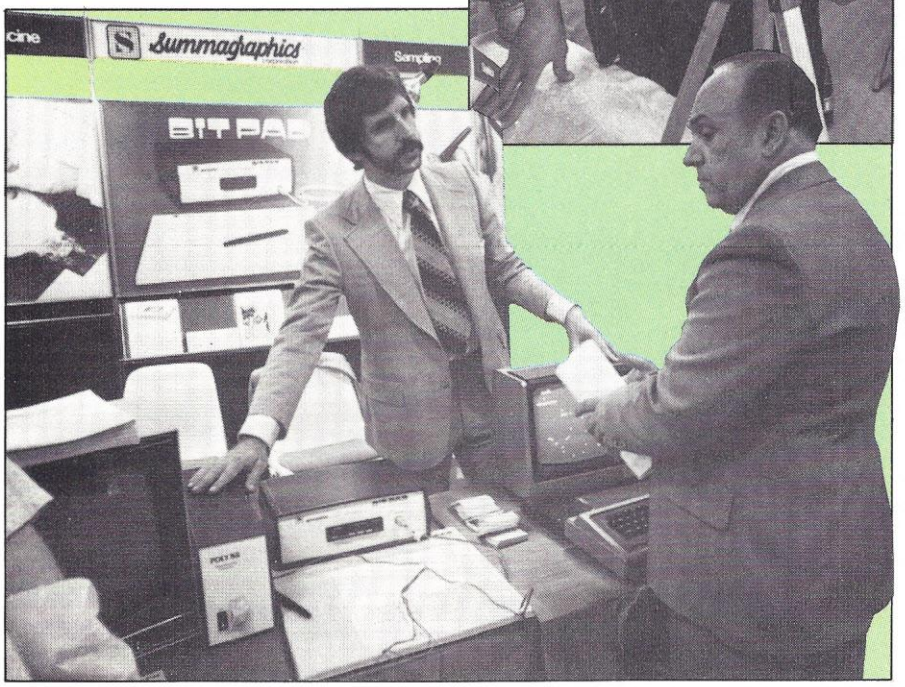
Over 10,000 people attended Chicago's Personal Computing Expo in October.

Computer Data Systems displayed their Versatile microcomputer system, which comes in various configurations adapted to the needs of businessmen, professionals, engineers, teachers and hobbyists. Customers can also buy combination hardware/software packages. For example, CDS's Accountant package includes not only dual drive system, impact printer and table, but also software for end-of-year accounting functions, accounts payable, accounts receivable, inventory, payroll and so forth.

Rhona L. Baverman (L) of Control Data explains the company's educational system.



Gerald N. Koppel, president of AAA Chicago Computer Center



Richard Parniawski (L) of Summagraphics discusses the Bit Pad with a customer.

Several companies offered business opportunities for entrepreneurs. Byte Industries sold Byte Shop franchises, while Photo-Fun, CASI and Digital Enterprises featured equipment for computer portrait businesses.

Traffic in the exhibition hall's first aisle often jammed around the Digital Group's booth, where a computer hooked to a speech synthesizer gave on-the-spot psychotherapy to passers-by. The computer's program – called "Sigmund", a variation of Joseph Weizenbaum's famous Eliza program – generated much interest and comment among attendees.

Digital Group's systems, which start at about $2000, are targeted at the "high-end hobby market – technical and heavy software people," said company president Dick Bemis.

Most of the popular microcomputers were displayed at the show, often running interesting demos. RCA's booth featured VIP computers playing games, controlling a model railroad and synthesizing music. Compucolor and Apple demos emphasized the color graphics capabilities of the units.

The Apple II, which retails for about $1200 with 16K RAM but without CRT, is quite a flexible system. In addition to color graphics capability, the unit features a fairly powerful BASIC and can be expanded with Apple peripherals including disks, printers,

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CIRCLE 12

Curtis Lee Rostenbach (R) of Data Domain demonstrates his line of products.

Dick Bemis (R), president of Digital Group points out features of the company's computers

modems, and memory and speech recognition modules. Software support is also strong and growing. Programs available from Apple include Checkbook, Finance 1 and 2, Dow Jones Stock Quote Reporter, plus numerous games such as Startrek/Starwars.

Compucolor II, called the Renaissance Machine, retails for about $1500 including CRT, disk and 8K RAM. Software available includes Personal Finance, Bonds and Securities, Equity, Chess, StarTrek, Assembler and Text Editor.

The TRS-80's popularity was much in evidence. Not only did Radio Shack display several machines at their busy booth, but other companies offered TRS-80 related products as well. For example, Jade Computer Products and Hobby World Electronics sold TRS-80 upgrade kits. Telpar's PS-48C thermal printer was hooked up to a Radio Shack computer via a Bootstrap Enterprises interface. (Though it wasn't displayed at the show, Jade also offers a non-standard "black box" printer for the TRS-80.)

One of the most intriguing products on display was Telesis Lab's VAR-80 Interface Unit, which allows a Level II TRS-80 to interact with the "real world". According to the company, the interface unit lets your computer function as a digital door lock, burglar alarm, power manager, frequency

Jim Brown (R) of Computer Data Systems chats with a customer

Gene Carter (C) of Apple Computer

Dr. Y.P. Chien (R) of Systems and Software talks with show attendees

counter, light dimmer, darkroom timer and so forth.

Digitizers represent another exciting, useful addition to personal computers. Two of these peripherals were at the show – Talos's Digi-kit-izer and Summagraphics' Bit Pad. These devices both input streams of x and y coordinates to the computer when the unit's pad is touched with a special pen.

While digitizers can be used simply as expensive electronic doodling pads, other applications also exist. For example, if you overlay the pad with a map or blueprint, you can use your computer to calculate distances and areas. Contractors could quickly determine how much concrete a building required, while plumbers could find how much pipe they'd need. Computer-aided design also benefits from digitizers. An engineer could, for example, first touch his pen to a drawing of a transistor, then touch the pen to the position on his circuit diagram where he wanted the component placed. The proper symbol would appear in the proper place on his CRT. Digitizers can also speed conventional data entry. For example, you could paste a questionnaire over the digitizer's surface, then simply touch the answer to each question.

Other applications seem limitless – curve and graph analysis for business and mathematics, layout planning for industry, real estate, landscaping and interior decorating, animated drawings for movies and films, image storage and manipulation for graphics arts, mapping

and plotting for cartography.

Both the Talos and the Summagraphics machines offer an 11" x 11" active surface area with 0.005" resolution. Summagraphics also offers an optional 0.1 mm resolution. The Talos data rate is 100 coordinate pairs per second, while Summagraphics features variable rates from 1 to 200 coordinate pairs per second. The basic Digi-kit-izer (without options) costs $449; the Bit Pad retails for $555.

Houston Instrument featured their Hi Plot digital plotter for personal computers. Priced at $1085, this peripheral moves a pen over a 7" x 10" image area, creating graphs, charts and diagrams.

As did the New York show the previous month, Chicago's Personal Computing Exposition mirrored the personal computing field. The old hands – hobbyists and kit-builders – were there in abundance. But growing in numbers are relative newcomers to computing – businessmen and professionals.

One man's story was typical. An owner of a small business, he'd set aside a certain sum to buy new electronic cash registers. He came to the show out of curiosity, and left with a handful of literature and a headful of new ideas. He was amazed to discover that a single, versatile computer might be a better, more profitable business investment than a store full of cash registers.

For More Information

Alpha Micro
17881 Sky Park North
Irvine, CA 92714
(714) 957-1404

Computer Data Systems
5460 Fairmont Drive
Wilmington, DE 19808
(302) 738-0933

Byte Industries
930 W. Maude Ave.
Sunnyvale, CA 94086

Photo-Fun
3701 North Ravenswood Avenue
Chicago, IL 60613
(800) 547-4264 x. 19

Computer Amusement Systems, Inc. (CASI)
11 West 20 Street
New York, NY 10011

Digital Enterprises
6033 North Sheridan Road
Chicago, IL 60660
(312) 275-5349

Bootstrap Enterprises, Inc.
100 North Central Expressway
Richardson, TX 75080
(214) 238-9262

Telesis Laboratory
P.O. Box 1843
Chillicothe, OH 45601
(614) 773-1414

Talos Systems Inc.
7419 E. Helm Drive
Scottsdale, AZ 85260
(602) 948-6540

Summagraphics Corp.
35 Brentwood Ave.
Box 781
Fairfield, CT 06430
(203) 384-1344

Telpar, Inc.
4132 Billy Mitchell Road
P.O. Box 796
Addison, TX 75001
(214) 233-6631

The Digital Group
P.O. Box 6528
Denver, CO 80206
(303) 777-7133

RCA Electro Optics and Devices
New Holland Ave.
Lancaster, PA 17604

Compucolor Corp.
P.O. Box 569
Norcross, GA 30071
(404) 449-5996

Apple Computer Inc.
10260 Bandley Drive
Cupertino, CA 95014
(408) 996-1010

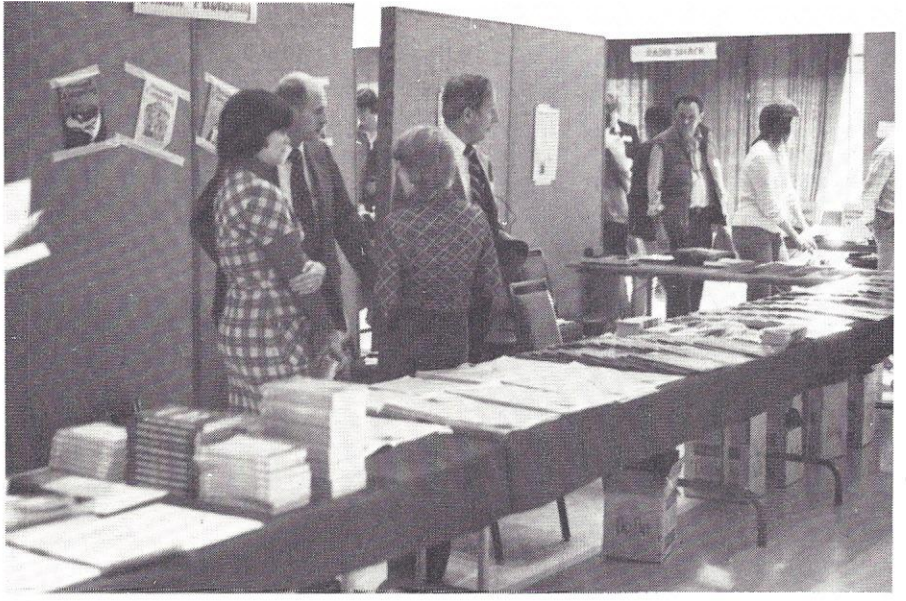
Jade Computer Products
4901 W. Rosecrans
Hawthorne, CA 90250
(213) 679-3313

Houston Instrument
One Houston Square
Austin, TX 78753
(512) 837-2820

Life In a Small Computer Show

BY HARRY SHERSHOW

While *Personal Computing's* big microcomputer show was taking place in Chicago this past October, Boston University decided to run its own little show in cooperation with The Boston Computer Society. Well, it wasn't a big shindig like in Chicago. If the Chicago affair was a three-ring carnival, this one was a church bazaar. The people who came – and there must have been close to 2000 that appeared in the course of the 7-hour show period – had as much enthusiasm as their Chicago counterparts. Most likely they had more. There was a psychological enthusiasm among Boston viewers that surely was absent at the Windy City. People at the BU show were, for the most part, not buyers but merely curious sightseers. This was learned from talking with various exhibitors who confessed that although sales were down, interest was quite high. It is the same attitude one sees in fancy department stores. People with money bulging out of their pockets come in, buy a chinchilla coat the way other people buy neckties and don't say as much as a "how do you do" to the salespeople. Those without money come merely to look. They touch, they feel, they ask questions, they hold items gently in their hands pretending they already own them. Enthusiasm overflows. They chat eagerly with salespeople asking them how they feel, and how are their families. At the Boston show they were like that. Everyone asking questions. Everyone shaking hands with everyone else. Everyone admiring the showcase products, and trying



"The table is set, the dinner is laid out, but where are the guests?"

them on for size and running their hands longingly over the keyboards and the CRT's. And if they had the money in their pockets that the Chicago people had in theirs, they would have bought out the show clean.

The place itself, in one of the conference halls of the George Sherman Union, wasn't large. When all the 30 or so exhibitors had finally set up their booths and were now waiting patiently for their first sales, there wasn't too much room left. Rows between booth displays were narrow and strollers had to squeeze past each other or press against tables or walk over wires or avoid packing-crates placed in some aisles because there wasn't any other place to put them. Actually, the size of the hall would have been ideal for something small, like a dog show or a lecture on a new Hindu religion. But the visitors to this little show didn't care. They loved it with a far greater passion than those attending the Chicago show. They had to because mostly they weren't buying – they were just looking. And many of these non-buyers hung around for most of the entire day. They didn't come in for a few minutes, look around, wander up all the aisles, take all free give-aways, and then skoot out to go catch the bus for a football game. It was football day at BU, which was playing Dartmouth up in New Hampshire. Buses were already lined up outside the building and students were leaving the computer show to catch the bus and go up into the beautiful New Hampshire coutryside, which was in the process of changing its foliage colors to the magnificent reds and yellows and magentas that make New England, in the Fall, the most colorful section in the United States. So you couldn't blame people for not showing up in great numbers or for not hanging around too long, if they did come. Besides, it was Columbus Day weekend and a 3-day holiday was in progress and people wanted to get away from where they were and go somewhere else. When the sun is bright and the air crisp and trees are ablaze in color, people cannot resist being attracted. BU beat Dartmouth 20 to 17 before the day was over and there was great joy on the BU campus later in the afternoon as word filtered in. But at the computer show, inside in the darkened, stuffy hall, the sightseers didn't give a hoot about football or the change of the foliage colors. They wanted to know the prices of the different microcomputers and the different peripherals. They didn't buy many of them but they did write the figures into little books they carried.

There were formal statistics associated with the BU computer show which were obtained from the sponsoring Boston Computer Society. This had been the second annual affair and "it was a successful turnout," was the official observation. Besides the exhibitions in the hall, there were five lectures going on in smaller side rooms. But nobody bothered to count attendance at these free lectures because the lights were low and it was hard counting heads in subdued light.

All the popular microcomputers (TRS-80, PET, Apple, etc.) were on display and all received a thorough workout from the spectators. They were not really trying to see how the things worked but were obviously eager to show their fellow visitors how well they could handle the keyboard. At a few booths, where computer-chess games were being shown, some chess-addicts snuck in a couple of tough games against the machines. A few novice chess players appeared quite reactive; their fists were clenched and their faces were red with anger because the computer had just beaten them. Even little BORIS, the harmless, walnut-finish, chess-playing box, got a good workout from the audience. Everytime BORIS made one of his

"Some machines were seen talking to themselves or announcing their presence."

"With no-one around to watch, a duck runs aimlessly across a display screen."

wisecracks, there was a lot of guffawing in the crowd. MICROCHESS had a game going on each of three computers (the TRS-80, the PET and the Apple II) all sitting side by side. You could compare the three displays and Apple II was clearly the best of all. Of course, it is not easy to play computer chess in a crowded exhibition hall at any time. The human player is shoved, heckled and thoroughly distracted by the many spectators leaning on him. The machine programs, on the other hand, meditate quietly in the recesses of their integrated circuits and have the advantage of undisturbed concentration. Most machines were victorious in their matches, it was learned, but only because of the distraction to their human opponents.

At a small computer show like this there is more interest in watching the spectators than in doodling with the exhibits. They are a curious lot. One mother breast-fed her baby in one of the booths, indifferent to the stares of the customers. A blind student wandered around pushing the wheel chair of his handicapped friend through the crowds and both stopped to pick up free literature and tap out a few commands on various keyboards. Even the blind chap knew the keyboard quite well and he wrote a message on the display and his friend told him what he had written. Youngsters, who didn't even know what a computer looked like, swarmed through the aisles picking up every bit of free literature being offered to the public.

There was no predominance of special age groups here, as both young and old rubbed elbows, squeezed past each other and chatted intensely with booth attendants or with friends. Two visitors, one about 14 and the other in his 50's were standing off in a corner arguing about the merits of the TRS-80, which the 14 year old owned, against the merits of Ohio Scientific's Challenger II, the older man's property. No one won the argument.

Visitors at BU's Fall computer show didn't give a hoot about football or the change of foliage colors.

The amount of business done at this particular show did not meet the pre-show estimates of the promoters. That was the opinion expressed by many of the exhibitors. They all agreed, though, that the poor results were due to the holiday weekend, the fall foliage festival in New Hampshire and the many Saturday afternoon football games going on in the area. It is a tough time to run a computer show in competition with such offerings. But one had to admit that those people who did show up at BU's George Sherman Union were true computer addicts who found a computer display more enticing than the blazing reds and yellows in the New Hampshire woods. Although the show may not have been a success for the vendors, it was a grand and glorious experience for the spectators.

One such spectator at the show, who refused to give his name because he didn't like publicity, had hitchhiked about 50 miles from Providence to get here. He is 17 and a high school senior. He had arrived when the doors opened at 10 AM and had stayed all day until closing time at 5 PM. He is a tall, thin, pale-faced youngster who looks as though he had given up eating lunch so he could save the money to buy another peripheral for his small system. For lunch, at the computer show, he chewed on a chocolate candy bar and drank a small carton of milk right out of the container. He owned a 16K microcomputer which he had purchased from his savings and from money saved by not eating lunch and doing odd summer jobs. He purchased the computer because it was the most exciting event happening in the field of science today and he wanted to be part of it. He stopped at every booth and asked a myriad of questions. He ran his fingers expertly over every keyboard and tapped out commands for listings of all programs in the computer. He knew how to do all that. He played a game of chess and even tried his luck at a poker routine. He didn't sit down once during the seven-hour showtime period but shuffled around the small hall in endless, repeating circles. Before the day was over he had purchased a cassette of the game of "Life" for $11, marked down from $17 because business at the show wasn't too hot.

With the cassette in his hand, his arms and pockets loaded with all the free literature he could find, and with a smile of satisfaction on his face he headed for the open road and the long hitch-hiking journey back to Providence. This youngster, like his ancestors before him who had crossed uninhabited prairies on desert schooners, is a true representation of the pioneer of today's computer age. He had had a wonderful time at the show and his last words, spoken over his shoulder as he hurried toward the highway, were that he would be back again next year.

COMPUTER CHESS
including
COMPUTER CHECKERS

HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

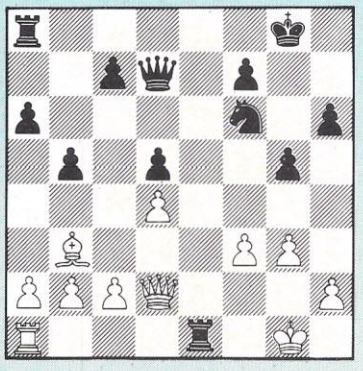
Bucharest report

The chess situation in Romania's "Magazinul" appears unresolved by the 20th move. Communications have slowed down and we have received only three moves in our latest dispatch (moves 18, 19, 20). The readers of the Bucharest newspaper are a tough bunch and they obviously are not allowing themselves to be overwhelmed by such a colossal antagonist as a $2,000,000 computer named Felix, otherwise known as "The Big Cat." The idea of playing a public chess game through a newspaper is not new, and there are suggestions that such an activity is responsible for the development of postal chess. Morris Miller offers an additional comment: "The late H.R. Bigelow ran a chess column in the New York Post around 1930 where he played against the readers, who eventually resigned. Without going into that too much, I feel the odds are slanted in favor of the *single* player, whether human or computer. The reason is that the opposition is a committee composed of all levels of ability and the vote of the tyro balances the vote of the more advanced player. One thing to note in the Romanian dispatches: the Romanians use the Algebraic system whose abbreviations are different from ours. (C = Knight, N = Bishop, T = Rook, etc.) This suggests an argument for a *universal* Algebraic system." The Romanian development so far (to the 20th move) with annotations by Morris Miller:

White – **ROMANIAN READERS**
Black – **FELIX**

1.	e2-e4	e7-e5
2.	Ngl-f3	Nb8-c6
3.	Bfl-b5	a7-a6
4.	Bb5-a4	b7-b5? (a)
5.	Ba4-b3	Ng8-f6
6.	0-0? (b)	Nf6xe4?
7.	Rfl-el (c)	d7-d5
8.	d2-d3? (d)	Ne4-f6
9.	Nf3xe5	Nc6xe5

After Blacks's 20th move



10.	RelxNe5+	Bc8-e6 (e)
11.	Bcl-g5	Bf8-d6
12.	Re5-el	0-0
13.	Nbl-d2 (f)	h7-h6
14.	Bg5-h4	g7-g5
15.	Bh4-g3	Bd6xBg3
16.	f2xBg3 (g)	Be6-g4
17.	Nd2-f3	Qd8-d7 (h)
18.	Q-d2	BxNf3
19.	g2xBf3	Rf8-e8
20.	d3-d4	RxR+

Annotations

(a) The standard books on openings condemn this as too early because it gives White opportunities: the weakness of the long diagonal d5-a8; the chance of an early break by a2-a4; and allowing the White Bishop to move on the long, strong diagonal b3-f7.

(b) Missing his chance. Instead, White's line of attack should be (with normal Black responses): d2-d4!; e4-e5; 0-0; Rf8-e8; h2-h3; BclxNh6; Nf6xd4; QdlxNd4 and Nbl-c3 with excellent chances. Both sides, though, must proceed with care. Black, especially, has many traps in his path.

(c) Again missing 7. d2-d4, e5xd4; 8. Rfl-el, d7-d5; 9. Nf6xd4, Nc6xNd4; 10. QdlxNd4, Bfl-c5; 11. Qd4xd5, Bc5xf2+; 12. Kgl-fl and, in view of the mate threat now at f7, Black must exchange and White comes out ahead in material. A typical variation where the opening of the King file is a latent threat, combined with the weakness on the long diagonal b3-f7.

(d) The readers can come out ahead with the following line: d2-d4; then d4xe5; then Qdlxd5.

(e) Now the computer threatens to work up a King side attack after Bf8-d6, gaining time, with the "Horowitz bishops" bearing down on the lone King. White's Bb3 is, for the present, out of the game and his Queen side is undeveloped.

(f) Now or earlier Bd6xh2+?; KglxBh2; Nf6-g4+; Qd1xg4! coming out ahead.

(g) Always capture toward the center, warns the book. How true! The chance to use the open file will not materialize.

(h) White can now simplify if he wants a draw with Nf6-e5 then Ne5xQd7 then RalxBdl followed by Rel-e7 etc. However, the Romanian readers go off on a different road at move 18. We shall see what develops later. –M.M.

The Playing of Sargon

(Last month Kathe Spracklen recounted the problems she and her husband, Dan, faced as they attempted to feed their chess program into the computer. She continues now with the events they encountered when they arrived at San Diego to participate in the microcomputer-chess tournament there.)

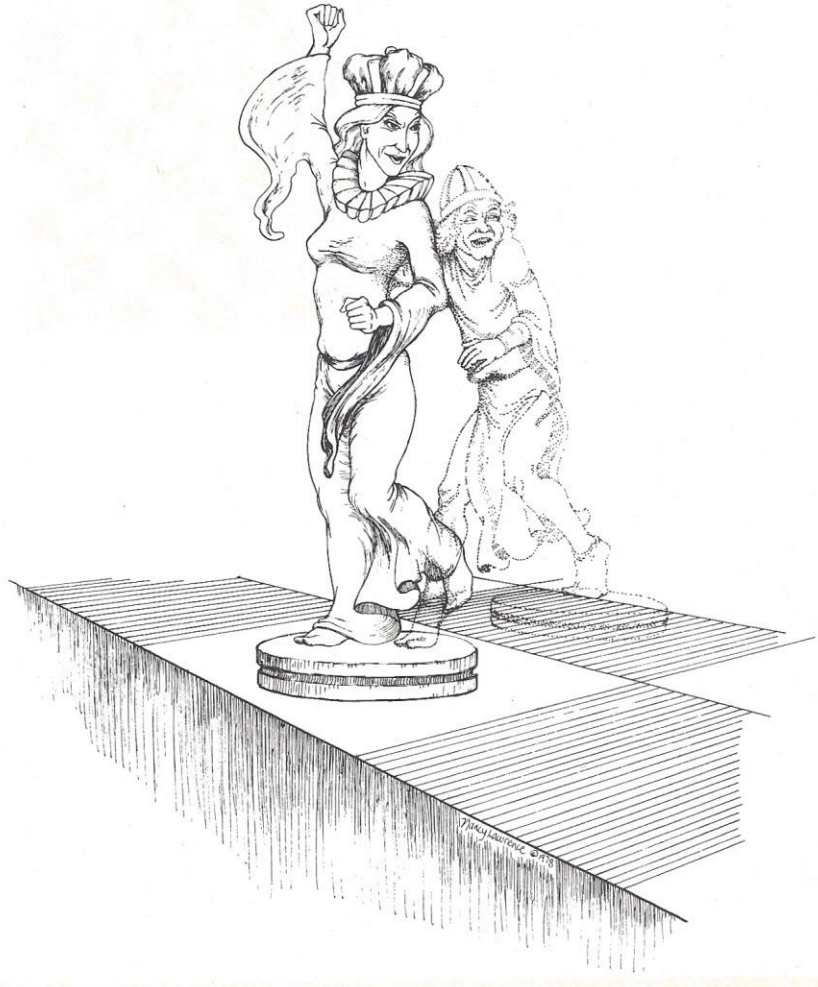
"Dan arranged for two days off from work and we left Thursday morning for the day-long drive. The weather was dreadful. Heavy rains followed us all the way up the coast. (In fact, the route we traveled was closed at Santa Barbara just a few hours after we had passed through because of heavy mud slides.) But our mood was as bright as the day was dark. Openly we assured each other that we would be happy if we managed to finish in the top half; although both of us secretly hoped for a first place victory. At 10 P.M. we arrived at my brother's apartment. Hot pizza, cold beer, and excited speculations filled the late evening hours.

"Friday morning at the Faire was a chaotic experience. The room assigned to the chess tournament was barely large enough to house the contestants. Ample electrical outlets had not been provided, nor were there enough extension cords to reach to all the machines. Some programs could not be brought up because of electrical interference. SARGON was set up in a corner and paired with two of the commercial boxes, Compu-Chess and Chess Challenger, for the first two rounds. The game with Compu-Chess was adjudicated a win after 58 moves. For SARGON it was the shakiest play of the whole tournament. Compu-Chess (set at level 4) had a pawn sitting on the 7th rank ready to queen, but fortunately for us, never pushed it. Finally SARGON captured that pawn, ending our worries. SARGON checkmated Chess Challenger (level 3) in 42 moves. On move 25 SARGON trapped Chess Challenger's Queen, and captured it on the following move. The room was jammed with crowds of people filtering through all day.

"With more extension cords available on Saturday, and more crowds expected, Larry Wagener and Roy Elder, tournament directors, decided on a rearrangement. Tables were placed in a semi-circle against one wall. The idea was to allow maximum room for spectators to filter through with minimum chance for game disruptions because of knocked out plugs. SARGON, now a two game winner, was beginning to draw more comment. We were paired with Processor Technology's 8080 Chess, fresh from its debut in Seattle against the giant computer there. The Processor Technology program was the early heavy favorite. In the tournament, so far, it had drawn a game with Boris and won against Compu-Color's program. Surprisingly, SARGON found it the easiest program to defeat. Processor Technology resigned after 25 moves, faced with a forced mate. During play of the game, a surprising Bishop-move into the line of attack of a pawn stunned assembled onlookers. A second look revealed that the pawn was pinned against the enemy king and was not only powerless, but doomed as well. The move was an emotional victory for Dan, since the pin finder routine had been the most difficult to debug and he had just put the finishing touches on it the night before we left for the Faire.

"The next round found us paired against a prototype model of Commodore's new Chessmate. The struggle went on all afternoon. Eventually SARGON won a Knight, but the outcome was still not clear after more than 60 moves. It was decided to adjourn the game until Sunday morning.

"On Sunday the Faire was scheduled to open at noon. The morning was our first chance to tour the exhibits. We arrived early and decided, before touring, to bring SARGON up so that those visiting the tournament room before game time could see the



graphics display and perhaps venture a game against the machine. We popped the cassette tape into the recorder as usual – but SARGON didn't load! There were no error messages. The tape just kept reading and reading. We tried again . . . same thing. Could something have happened to the tape? We tried the back-up tape. No load! Perhaps it was the cassette recorder? Dan ran to the car and got another one. Still no load! By this time we speculated that the tapes had been erased accidentally. But they'd been in my purse the whole time! The morning soon vanished. It was almost time to restart the adjourned game. Suggestions came from all around, but nothing worked. I couldn't take the suspense any longer and I went to pace nervously in the exhibit hall.

"In the exhibit hall I ran into my brother and told him of our dilemma. He mentioned that a representative of the company where we had bought our computer was here at the Faire. I had him paged, while my brother went to see if he could help. Game time arrived and the start of the round was delayed for us. We were warned though that with Sunday a short day, the game could not be held up too long. If we didn't get a load soon, we'd have to forfeit both the adjourned game and the last round of the tournament.

"Finally the cause of the difficulty was determined. A pin connector to the cassette recorder had come unsoldered. There was no time left for repairs, even if someone had thought to bring a soldering iron. A hand-held connection worked to load the program. The day was saved! But the suspense wasn't over. Play resumed on the adjourned game with Chessmate. SARGON won a pawn to increase its advantage. But just when a win seemed secure the programs went into repetition of position – a three move cycle that both machines seemed determined to follow. Under Faire rules for this event we were allowed to adjust our look ahead to attempt to break the lock up. A change from 2 to 3 ply didn't help. We tried dropping back to 1 ply. The moves repeated in the same maddening pattern. Not wanting to concede the draw, we pushed SARGON to a 4 ply search, a dangerous maneuver that risked loss on time forfeiture. The first move in the pattern repeated. We held to the same depth of search. The second move in the pattern repeated. This was our last chance. If the third move repeated, the game would go down as a draw. We held our breath.

"A different move at last! A check of the enemy King that won for us another Pawn in the process. Now a Knight and two Pawns up, the game was adjudicated a win for SARGON. The final round was not uneventful. SARGON ventured into some risky territory, but Dan and I were both so numbed by the events of the morning that we scarcely followed the game. We had both caught colds in the rain that hadn't let up all weekend, and I was beginning to feel flu-ish as well. SARGON, fortunately, could feel no exhaustion. It calmly pounded its way to victory, finishing up with five wins, no draws, no losses.

"After the awarding of prize certificates, Alan Benson played all the programs in a simultaneous match. It was SARGON's first loss. A group of us went to dinner after all the machines had been packed away. I was feeling distinctly ill and relished neither the food nor the conversation.

"The long trip home was delayed over night because of the weather. All roads between San Jose and San Diego were closed that night due to heavy rains and flooding. We finally ventured out in the morning still uncertain whether we could get through. But the rain had subsided and the dependable California sun shone brilliantly. It was a quiet, uneventful trip home for two sick victors."

(Hayden Book Company is now marketing Sargon in either cassette form or in hard copy. Information on these prize winning programs can be obtained by writing to Kathe Spracklen, 10832 Macouba Place, San Diego, CA 92124.)

From Jerusalem

During the Jerusalem Tournament, which ran August 6th to 9th, 1978, the surprising development, of course, was the emergence of DUCHESS as winner over CHESS 4.6, CHAOS, and three other programs. An explanation of why Duchess beat out CHESS 4.6, which still retains the title of world's champion, is offered by Tom Truscott, of Duke University, one of Duchess' three-man programming team.

"This was not a 'title' competition," says Tom. "It was an ususual tournament in that all the machines were provided by Israel and not by the contestant. Hence, the tournament was not restrictive as has been the case in the past, where the playing levels depended a good deal on what computers were being used. In Israel, the relative machine speeds of the top three programs were nearly equal! This is taking into account the following:

(a) Neither CHAOS nor CHESS 4.6 computed on opponent's time (as they usually do.)

(b) CHESS 4.6 was unable to use Extended Core Storage (ECS) for its position table.

"The machine allocations in Israel were as follows:

Program	Computer	Utilization	Computer location
DUCHESS	IBM 370/158	.80	Bank of Israel, Jerusalem
CHESS 4.6	CDC Cyber 74	.90	Hebrew University, Jerusalem
CHAOS	IBM 370/168	.50	Office Mechanization Ctr.
OSTRICH	NOVA 3	1.00	Tournament site
TELL	HP 2100	1.00	Tournament site
BS '66 '76	IBM 370/168	.50	Office Mechanization Ctr.

"Machine speed was an important difference in Israel. Northwestern estimated a factor of 10-12 slowdown for running on the Cyber 74 instead of the 176.

We estimated a factor of 4 slowdown by running on the IBM 370/158 instead of our usual 370/165. The result was a match between comparable machines. Duchess was just lucky."

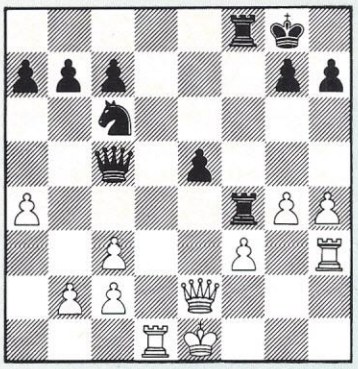
A more detailed report on the achievement of DUCHESS has been prepared by Dr. Alan Biermann of Duke University's Computer Science Department.

"The Duke team was especially pleased with this win over Northwestern's Chess 4.6," observes Dr. Biermann. "A close rivalry had developed between the two teams during the past year. In August, 1977, Duke had lost to Northwestern in the world championship tournament at Toronto but tied for second place with the program. In October 1977, Duke tied Northwestern for first place in the North American Computer Chess Championship Tournament in Seattle. The Jerusalem victory was the first time Duke has defeated Chess 4.6 which has dominated computer chess for the past several years. The Duke program was developed on the Triangle Universities Computation Center IBM 370/165 machines and was written by Tom Truscott, a graduate student in computer science, Bruce Wright, a staff member of the Duke Medical Center Cardiovascular Computer Laboratory, and Eric Jensen, a former Duke undergraduate and currently a programmer for a New Jersey computer firm. In the tournament room in Jerusalem large display chess boards were set up so that they would be easily visible to the large audience, and the two competing teams associated with each board set up computer terminals nearby which could communicate by phone lines to computers throughout Israel. These borrowed computers were made available by private firms and government institutions in Israel and are similar to machines used by the teams at their home institutions. The fact that borrowed machines were used was a great disadvantage for Northwestern because in previous tournaments at home, CHESS 4.6 had had the use of one of the fastest computers in the world, a CDC Cyber 176. In Israel, the Northwestern team was forced to use a machine which is comparable in speed to the machine used by Duke. Subsequently, the Northwestern and University of Michigan (CHAOS) programs finished the tournament in a tie for second place.

"Duke's chess effort began about seven years ago when Bruce Wright and Tom Truscott were chemistry laboratory partners during their freshman year. Wright was an expert chess player and both had strong interests in computer programming. They began work on DUCHESS which went through considerable development and several major revisions before it was entered in its first national competition in 1974. It finished eighth among a group of a dozen programs and in the following two years placed fifth. DUCHESS attempted to simulate the thought processes of expert players by formulating plans of attack and searching for move sequences to carry out its plan. It typically would examine only about 1,000 boards before making each move.

"In May of 1977 the programmers decided to rewrite DUCHESS. The resulting program yielded a new version of DUCHESS which examined approximately 100,000 boards before making a move. (In Israel, on the IBM 370/158, DUCHESS could only examine 20,000 boards.) This revised program showed its power in August of 1977 in Toronto where it beat the then world champion KAISSA in the first round of play. Duchess finished the contest in a tie for second place

After Whites' 23rd move



White – BS '66 '76		Black – **DUCHESS**
1.	P-K4	P-K4
2.	N-KB3	N-KB3
3.	NxP	P-Q3 (a)
4.	N-B4?	NxP
5.	N-B3?	NxN
6.	QPxN?	B-K2
7.	Q-R5	0-0
8.	P-B3	P-Q4? (b)
9.	N-K3	P-Q5?
10.	B-B4??	PxN
11.	BxP	B-K3?
12.	BxB	PxB
13.	R-Q	Q-K
14.	Q-K5	B-R5ch
15.	P-N3	N-B3
16.	Q-K4	B-B3
17.	B-B5	B-K2?
18.	BxB? (c)	QxB
19.	P-QR4	Q-B4
20.	P-KN4	P-K4
21.	P-R4	R-B5
22.	Q-K2	QR-KB
23.	R-R3 (d)	RxRP
24.	**Q-B1**	R-R7
25.	Resigns	

Annotations

a) Necessary in the Petroff Defense, since if Black plays 3 . . . . NxP?; 4 Q-K2 will win White a Pawn eventually because Black cannot play 4 . . . N-B3; 5. N-B6 discover check, etc.

b) The Knight is not on a good square; why drive it to one?

c) He might as well take the pawn Black offers.

d) (See Diagram.) Now Black misses a fine continuation: 23 . . . P-K5! 24. PxP, RxKP; 25. QxR, Q-B7 mate. Once the center is cracked, White's game collapses. – **Morris Miller.**

with KAISSA. Some observers have suggested this was simply a lucky series of games for DUCHESS. However, in the November tournament at Seattle, DUCHESS again demonstrated its playing ability by tying CHESS 4.6 for first place in the North American Championship Tournament. Academic advisors to the project are Drs. Alan W. Biermann and Dietolf Ramm.

"Computer chess programs have not yet been refined to the point where they can defeat the best human chess players. However, they can beat most amateur players and can defeat master players in 'speed chess' which requires the players to hurry through the game at the rate of several moves per minute. For example, both DUCHESS and Chess 4.6 have played against International Chess Master David Levy and have defeated him in 'speed chess.'"

In the first round at Jerusalem, DUCHESS played against the Netherlands' BS '66 '77 in the accompanying game:

A chess program, Part VIII

(This complete dissertation by Mike Valenti on how to write a computer chess program is presented in monthly sections as a guide to those wishing to write their own programs. Although designed to be run on a large computer, this program with proper modifications can serve also as a model in writing a chess program for smaller memory-systems – even the microcomputer. This program is written in BPL (modified XPL), but it can be written in other languages as well – with proper transitions.)

Prior to application of the heuristics, the program determines which pieces are under attack on both sides. For each of these pieces, a detailed exchange evaluation is made, and the results stored in the attack lists (for the enemy's pieces attacked), and the defense lists (for the machine's pieces attacked).

The following information is retained in these lists: (1) the square number hit, (2) the square number hitting, (3) a flag indicating whether the attack is damaging or not, and (4) a flag indicating whether there is a multiple attack on this piece. In addition, the defense list retains a value indicating the amount lost in the exchange, if it is damaging, and the attack list retains the number of attackers, if it is a multiple attack.

The attack evaluation is broken down into five sections so that it can be used for attack evaluation for proposed moves, where the information must be modified between calls to these sections. The five modules are: "LIST SQUARE HITTERS", "ADD HIDDEN HITTERS", "ADD UNPINNED PIECES", "ADD KINGS", and "EVALUATE ATTACK" (These modules will be more fully described later.)

Information for the attack evaluation is taken directly from the data structure for the board position.

"LIST SQUARE HITTERS" picks up the pieces directly attacking the square being considered, and places them in an attacking piece list and a defending piece list. The first item in the latter is the attacked piece and it is counted in the total number of defenders. Parallel lists are kept retaining the piece values of the respective pieces taking part in the exchange.

The first thing "ADD HIDDEN HITTERS" does is to sort the attacking and defending piece lists and their value lists in ascending order, according to their values. In all exchanges, the minimum valued pieces take part in the exchange first. The next part of the procedure looks for pieces behind directly hitting pieces up to two levels. So up to three pieces in a row can be detected as hitting a square. The pieces detected behind the direct hitters are added after those pieces and after any lesser-valued pieces, to preserve the capture sequence.

"ADD KINGS" is a special routine to add the kings to the ends of the lists, if possible. The data structure may not contain the correct information, since the kings may be hitting squares that are also hit by enemy pieces. In this case, the kings would not be considered as hitting the squares, but they might legally take part in an exchange on these squares.

The "EVALUATE ATTACK" routine takes the lists created by the above four routines and determines whether the attack is damaging or not. An attack is considered damaging as soon as a lesser-valued enemy piece captures a greater-valued friendly piece, or the total value lost by the friendly side is greater than the total value lost by the enemy side. This routine must also check if the kings can legally take part in the exchange.

Contained in this article is an example of an exchange. It shows the lists created from the board position, for an attack on the black pawn on square C3.

```
5  BQ  **  -  BN  -
4  **  BB  BR  -  **
3  --  **  BP  WR  BR
2  **  WQ  **  WP  **
1  WB  **  -  WN  -
   A   B   C  D   E
```

The attack, on the BP on C3 would evaluate in favour of black, and thus would be an undamaging attack.

When the program selects all the legal moves and applies all the heuristics, it will re-evaluate attacks on the to-squares, or re-evaluate attacks when a new attacker has been uncovered, or a new defender added. In these cases, the information obtained from the data structure before a move is made, is inaccurate.

For instance, in one particular heuristic uncovered attacks are evaluated. In that case, a check must be made to see if the intervening piece moved has now blocked an attacker or defender. In this case, the routine "DELETE" (explained in an upcoming section) is called with appropriate parameters to delete items from the lists. Similarly, if the intervening piece now attacks or defends the square on which the attack is being evaluated, the routine "MODIFY LIST" is used to add items to the lists.

These various actions are performed between calls to the different sections of the attack evaluation.

"ADD UNPINNED PIECES" checks to see if any of the attackers or de-

fenders have freed pins on pieces that may now participate in the attack evaluation. It references some lists that are created when the pin was discovered, and modifies the attackers or defenders piecelists, if possible.

After this exchange evaluation, tables of information are generated that can be used as the heuristics are applied to each move. The HEURISTICS routine generates and tabulates information that applies to a specific move and that can be used by any heuristic. *(This routine will be discussed next month.)*

Micro-Masters Tournament

News that world-champion computer-chess programmers David Slate and Larry Atkins have deserted the giant computers to join the Chafitz Company where they are putting new strategies into the BORIS chess program does not overshadow the reports coming from Santa Barbara. There, Don Gerue and Russ McNeil have been conducting the First Annual Micro Masters Tournaments where all leading micro-chess programs are being evaluated. With each passing week the tournament develops more surprises and more suspense. The latest dispatch from Don Gerue and Russ McNeil describes the events to date:

"Twenty seven of the 56 games of this tournament have now been completed," they report. "The score sheet tells much of the story but we hope that the footnotes add some flavor. 'Twenty seven games' – doesn't sound like much when you say it fast but most of the games take from four to seven hours and with all that kibitzing time available we have become sort of frustrated experts on the habits of small-computer chess machines. The frustrated part comes from watching the ineffective end-game routines and the 'rook shuffle'. The designation of 'experts' comes from looking at upside-down mirror-image notation, octal notation and several different forms of graphics, not all of them ideal representations of chess pieces. Some of the little quirks we have noticed so far:

"MICROCHESS 1.0 – Loves to sacrifice for a chance at a check. Will attack until the lumber yard is empty.

"SARGON 1.0 – When playing against it, you are tempted to punch the video display in the mouth during the end game. SARGON just does not know how to proceed. This is not surprising as it is playing two ply except when breaking 'hang-ups'!

"ATARI – Best graphics of the bunch and it plays well, too. At this writing it has only tangled with the lower-ranked programs so far. We are waiting for a new, updated program to arrive which will probably be in a few weeks.

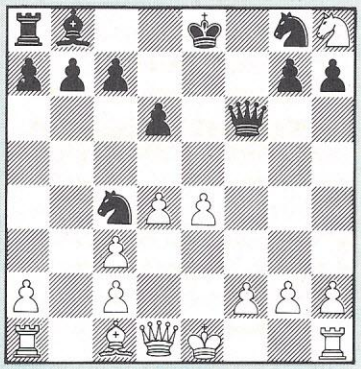
"CHESS CHALLENGER 10 – A real improved package over the 3 Level unit even at the $275 price tag we parted with. (A week after we purchased it, Sears' Christmas Catalog had

One of the early contests in the Micro-Masters Tournament occurred between Atari Level-3 and Microchess 1.0. Microchess has been upgraded, at this time, to what the manufacturing company calls a 2.0 level. Atari, also, is about to come to market in a new, upgraded version. The following game was played at the lowest levels of both machines, and can be compared to a contest between "beginners" at chess.

White – Atari-3
Black – **MICROCHESS 1.0**

1.	P-K4	P-K4
2.	N-KB3	N-QB3
3.	P-Q4 (a)	B-N5 ch?
4.	N-B3	BxN ch
5.	PxB	Q-B3?
6.	B-QB4	N-R4 (b)
7.	NxP?	P-Q3
8.	NxBP	NxB
9.	NxR	B-Q2? (c) see diag.

After White's 9th move



10.	Q-R5 ch	P-N3
11.	QxRP	N-K2
12.	P-KB4	P-KN4?
13.	Q-R5 ch	K-B
14.	PxP	Q-N2
15.	0-0 ch	K-N
16.	N-B7	R-KB (d)
17.	Q-K2	N-R4? (e)
18.	N-R6 ch	K-R2
19.	B-B4	N(R4)-B3
20.	N-N4	B-K3? (f)
21.	R-B2?	N-N3
22.	N-B6 ch	K-R
23.	Q-R5 ch and mates in next move.	

Annotations

a) Letting Black equalize easily with its moves of . . . PxP, . . . N-B3, . . . B-N5, . . . QPxN, . . . P-Q4, etc.
b) After 7, B-Q3, N-QB3 (eventually would have to be played), White would simply be a tempo ahead.
c) Instead, 9 . . . P-KN3 was necessary.
d) And now White's line of attack: N-R6 ch. then N-B5 ch. then QxQ ch and finally NxN wins more easily.
e) Instead, 17 . . . B-K3 would be better.
f) BxN was necessary because White could now shorten the game as follows: 21 N-B6 ch. since if the King moves, Q-R5 mates; and if 21 . . . RxN then 22. PxR, QxP; 23 Q-R5 ch, K any; 24 B-K5! wins the Queen or mates.
Conclusion: A sad exhibition for two machines. – **Morris Miller.**

it for $200. Oh, well!). The external package and the pieces of Level 10 are a cut better than previous models.

"BORIS – (New Model). Runs faster and has a new set of wise-crack comments that make you feel as though you were at the local chess club. BORIS has the distinction of being the first and only micro-computer to win a game against SARGON 1 in competiition so far. However, waiting exactly 3 minutes and 20 seconds for each move is sometimes a little exasperating.

"The special rules for this tournament are similar to those used at the San Jose Tournament. All standard chess rules are in effect with some additions to allow for more meaningful results in special cases. The special cases include:

"1. Time allowed is 40 moves within 2.5 hours and 20 moves per hour thereafter. Time is measured when the computer begins to operate on the move. (This is at variance with the rules for 'Algorithmic Players' in the latest USCF rules. However, the translation of input data and the time variance between human operators dictate that a contest between computers be conducted in this way.)

"2. If a draw by repetition occurs the operator will attempt manual intervention to raise the level of 'look ahead' and thereby allow the program to find a different move. This can only be done to the extent that sufficient clock time is available. (This rule, again is in conflict with the current USCF rules which allows only the computer to request the time remaining for both itself and its competitor). Because most microcomputer programs do not, as yet, have a capability for automatic adjustment of ply level, it was felt that this intervention was justifiable. This procedure is identical with that followed at San Jose and it was requested by the programmers involved.

"3. If a computer cannot conform to the standard rules of chess and if an opponent's move requires an action that cannot be entered or performed by the computer, then the game is forfeit. (No examples of this have as yet, been encountered here at Santa Barbara. But some of the programs have promotion problems where they cannot allow more than one or two queens on the board).

"Within the next 3 or 4 weeks we will have most, if not all, of the games completed. At that time, and with the results in hand, you will be able to make a definitive judgement of the relative playing abilities of all these programs as they relate to one another. But just one word of caution. When we play against these programs, the programs seem much smarter than when they play other programs. This is particularly true in the early stages of the game. One factor may be that kibitzers always see the best move until it is their own turn to move.

"When our tournament is completed the top two programs will be taken to San Diego to compete against a new, upgraded SARGON. Dan and Kathe Spracklen report that their latest program is almost ready. They were rushing it a little to have it available for the ACM competition in Washington DC which ran December 3rd. For the Micro-Masters champions who challenge Sargon it will be an opportunity to compete against next year's generation of programs and should provide some new and interesting comparisons. We would appreciate any suggestions or questions regarding this and the future Micro Masters Tournaments." Russ McNeil and Don Gerue can be reached by calling them at (800) 682-1270. Or letters can be addressed to Don Gerue, 3667 Montalvo Way, Santa Barbara, CA 93105.

The following score sheet shows results as of the filing of the above report. CHESS CHALLENGER 10 was leading with a percent of .88 and with eight "half" games already played. BORIS, on the other hand, had a percent of .50 but has only played 5 "half" games. How will they be doing by the time of the next report? (Watch for the Micro-Masters Tournament dispatches as they arrive from the game site.)

The California Micro-Masters chess tournament, is conducted by Don Gerue and Russ McNeil on an annual basis to test microcomputer chess-programs against each other. The tournament will now be called the "PENROD MEMORIAL COMPUTER-CHESS TOURNAMENT". This change in name is in tribute to Doug Penrod who enthusiastically organized the first microcomputer chess tourney, in San Jose, and was extremely active in promoting computer chess. Doug Penrod died November, 1978.

SCORE SHEET

	CONTESTANTS		OPPONENTS #1	2	3	4	5	6	7	8	9	Current Percent	"Half" Games Played to Date	FINAL SCORE	FINAL POSITION	
1	MICRO-CHESS 1.0 (Heath H-8)	W			½	Ø	1	Ø			Ø			.22	9	
		B			½		Ø	Ø			Ø					
2	MICRO-CHESS 1.5 (TRS-80)	W	½					Ø			½			.4	5	
		B	½								½					
3	MICRO-CHESS 2.0 (PET)	W					1	Ø		½				.42	6	
		B	1					Ø		Ø						
4	CHESS CHALLENGER (3 Level)	W	1						½		½			.31	8	
		B	Ø		Ø				Ø	½	Ø					
5	CHESS CHALLENGER (10 Level)	W	1		1				1	½				.88	8	
		B	1	1	1					½						
6	BORIS	W					1			1				.5	5	
		B					½	Ø		Ø						
7	SARGON I (TRS-80)	W			1	½	½	1						.57	7	
		B			½		½	Ø								
8	ATARI	W	1	½		1								.75	6	
		B	1	½		½										
		W												54/2 GAMES		
		B														

Note: Two "half" games (program plays White first; then, Black)=one full game.

A 10-year-old bet comes to an end

Writing in the September issue of the ICCA Newsletter, David Levy claims that Professors McCarthy, Michie, Papert, and Kozdrowicki were overly optimistic 10 years ago when they bet him $2,500 that a computer would win a chess match against him by August 1978. Levy's choice of words, according to some observers at MIT to whom we talked, was not very accurate. The professors may have been *prematurely* optimistic, say the observers, but they were not *overly* optimistic. A quick poll taken among some of the students at MIT, who are involved in computer science, reveals that confidence persists that a computer will soundly trounce the English International Chessmaster at some time in the future. When that will happen, no one knows. But you will note, say the dissenters, that David has decreased the longevity of his bet from 10 years to five and is only risking $1,000 this time, not the £2,500 of his original bet. If he were wise, they say, he would decrease the bet still further. The students believe that poor David, like poor Richard, will soon be writing a new song in his Almanac.

Dave Cahlander, of Control Data Corporation, together with David Slate, one of the original programmers of Chess 4.7, ran the CDC Cyber 176 from Northwestern against David Levy in Toronto last August. The contest was the culmination of Levy's ten-year bet that was due to expire – because of one of the original conditions – on the last day of August, 1978. David won his wager in Toronto but lost a game to the computer. So, the match recorded an historic double victory: an international chessmaster beat a computer in a regular match, and a computer won one game (and drew another) from the master. It was the first time a computer has been able to beat a human in a regularly scheduled tournament game. Dr. Dave Cahlander reports the event in the following dispatch.

"In England in 1968, David Levy predicted that no computer would be able to win a chess match against a first-rate player. A wager of 1250 pounds developed between Levy and four computer scientists, with Levy claiming that no computer would be able to defeat him personally within ten years.

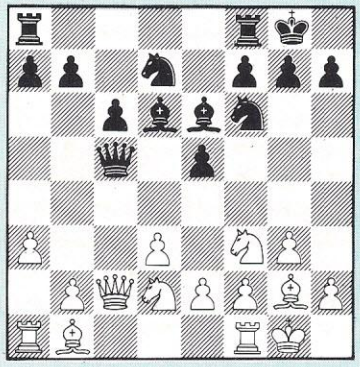
"The first challenge match took place at Carnegie-Mellon Institute on April 1, 1977, with Northwestern University's CHESS 4.5 running on the newly announced CDC CYBER 176. Later he played against the Russian program KAISSA and the MIT Greenblatt chess machine. It had been stipulated that the computer must score more than 50 percent to win a match. By winning the first game of each of the two-game matches, Levy remained victorious.

"The final opportunity to test Levy vs. Machine was a 6-game match at the Canadian National Exhibition in Toronto, August 26, 27, and September 2-4, 1978. The challenger was Northwestern University's CHESS 4.7 on the CDC CYBER 176. The computer required 3½ points to win the match, against three points needed by Levy to win. Five games were played, resulting in a draw for the first one, a win by the computer in the fourth, but wins by Levy in the second, third and fifth rounds. This made a total of 3½ points for Levy, 1½ for the machine. International Master Levy had now won his wager!

"The games that were played illustrated graphically the strengths and weaknesses of computer chess. They also demonstrated some interesting weaknesses of human play. CHESS 4.7 is designed to analyze all continuations of play to a certain number of moves. The depth of analysis depends upon the amount of time budgeted for a particular move as well as the complexity of the position. With more time the analysis goes deeper and more is learned about the position. However, some positions that have forcing lines require a lot of depth on particular branches and not much analysis on other branches. The human is able to sort out which lines require the deeper study, but the chess program does only as it is told and gives all lines the same depth of study. On the other hand, game two illustrates how an International Master, knowing that he has already won the game, can miss the quickest route to checkmate.

White – LEVY		Black – CHESS 4.7
1.	P-QB4	N-KB3
2.	P-QR3 (a)	P-QB3
3.	P-Q3 (b)	P-Q4
4.	Q-B2	PxP
5.	QxP (c)	P-K4
6.	N-KB3	B-Q3
7.	P-KN3	B-K3
8.	Q-B2	QN-Q2
9.	B-N2	0-0
10.	0-0	Q-N3 (d)
11.	QN-Q2	Q-B4 (e) see diag.

After Blacks's 11th move



12.	Q-N	P-KR3?
13.	P-QN4	Q-N4
14.	Q-B2	N-N3
15.	B-N2	P-QR4
16.	P-QR4	Q-R3
17.	PxP	QxP
18.	B-B3	Q-B4
19.	KR-B (f)	QN-Q2
20.	P-R5	Q-R2 (g)
21.	Q-N2	N-N5
22.	N-K4 (h)	B-B2
23.	P-R3	P-KB4 (i)
24.	PxN	PxN
25.	PxP	BxNP
26.	B-K (j)	N-B4 (k)
27.	R(B)-N1	R(R)-N1
28.	B-Q2 (l)	R-B2
29.	B-K3	B-Q3
30.	Q-B2 (m)	BxN
31.	BxB	R-R
32.	R-QB	P-QN3 (n)
33.	K-N2	Q-N2
34.	PxP	RxR
35.	RxR	N-K3
36.	R-R7	Q-B
37.	Q-R2	R-B3
38.	R-R8	B-N
39.	B-N4	K-B2
40.	Q-R7ch	BxQ
41.	RxQ and wins	

Game number 5 found the computer running into machine trouble for the first time during the match. There was a brief breakdown after the fourth move. But after the 26th move, the CDC developed more serious malfunctions. Repairs were attempted with the clock still running, but the problem was not solved. Faced with the alternative of losing on a time forfeit, the machine was restarted – its problems still unresolved. The time for each move was, at this point, decreased from 167 seconds to 63 seconds, to make up for "down time." After the 41st move, however, the machine had no chance of winning and gallantly resigned on the 43rd move. Mechanical problems encountered during this game may have affected the play of the machine, said Dave Cahlander later. The fifth game, which became the last of the match is annotated by Morris Miller.

Annotations:

a) Takes the machine out of the books. The move can transpose into many variations often played (the Sicilian Defense, with colors reversed).
b) Again out of the books but if 3-P-Q4, P-Q4 with a regular Queen's Pawn opening in which White has practically thrown away a move by P-QR3, which is of little use in this line.
c) White is ready to lose time with repeated Queen moves to keep the game unorthodox.
d) Here the computer goes astray. Q-K2 instead was the solid move.
e) If White now wishes to avoid exchanges of Queens he could try: N-B4, then P-QN4, then P-K4, then N-K3, winning a piece, and all with appropriate responses from the computer. There are other variations radiating from this line all leading up to continued Queen side pressure. Black is threatened and offered a swap at the same time. If the swap is accepted the computer opens a file and White's two Bishops now give him a strong game. This note points up the error of CDC's 10th move.
f) Now threatening BxP.
g) The computer flounders here. Either N-Q4 or even B-B2 is better.
h) Evincing a desire to mix it up. Otherwise P-K3 with P-KR3 to follow is quite safe.
i) Forced positionally. But the result isn't bad for the CDC.
j) Overly nervous. Instead, B-Q2 and B-K3.
k) White cannot play 27 NxP, BxN; 28 QxB, N-N6.
l) Now after 28 . . . NxP; 29 B-K3, Black cannot protect the King Pawn by Q-N as the Rook already occupies that square. Black's Queen is non-mobile.
m) Threatening NxP.
n) White is in no hurry to liquidate the Queen side, though even 33 PxP, QxR; 34 RxQ, RxRch; 35 K-N2, Knight moves and QxP wins.
Conclusion: Apparently machines, too, can have an off day.

– M.M.

Do chess-computers cheat?

Ever since the conviction of Galileo Galilei on charges of tampering with Natural Laws by means of scientific instruments, lay people have shown a natural suspicion toward scientific research. Elementary-school students are familiar with the stories of how the public laughed at the first steam engine, hooted at the cotton gin and passed ordinances against the automobile. Human beings harbor an understandable feeling of resentment toward any new contraption that simulates human behavior, including the computer. Chess players, in particular, look with a good deal of skepticism at computers that play 2400 chess. Such suspicion becomes intense when the computer actually manages to outwit a human opponent. A Control Data Cyber 176 computer recently beat an international chessmaster in one game, and drew another, during a five-game match. Accomplishment like this, from "dumb" computers, naturally stir up protests of cheating on the part of the machine. Such a public statement was made earlier by Harold Dondis in a chess column he edits for The Boston Globe, a daily newspaper in Boston, Mass. The declaration is not new. It has been made many times before by sensitive members of chess clubs all over the world. Is it justified, however? Does the computer actually cheat, by any of the rules that define cheating? Harold Dondis offers the following argument for his statement:

"Rules of tournament chess," he wrote, "forbid physical moving of pieces by any player on any board, prior to making a move. Computers must of necessity disobey this rule since they have no mind and must use a physical analog; must move the pieces on a board and examine millions of positions. Thus, the contest between man and machine is unfair, for the computer moves pieces around before its moves while the man does not. Also, the computer, in using prepared openings, is studying a book *during* a game, also forbidden by the laws of chess." Anyone involved in computer-chess obviously would not permit such a statement to go unchallenged. Of the many responses we received, one posed the human question: "How can a human chess player solve a three-mover end game unless the human himself continually moves pieces around in his mind until he finds the proper solution? In a game of chess the human does the same thing again." A more scientific response was received from Dr. I.J. Good, University Distinguished Professor of Statistics, Virginia Polytechnic Institute. Dr. Good has long been associated with research in artificial intelligence and has written many historic landmark papers on the developments of the logic of computer chess. His response to the Boston Globe "accusation" follows:

"Harold Dondis, in the Boston Sun-

day Globe, Sept. 17, 1978, argues that computers cheat when they play chess. His argument is that they use a physical representation of the board when analyzing a chess position; whereas one of the rules of over-the-board play is that a (human) player is not supposed to use physical adjuncts.

"This argument seems to overlook the fact that the brain is a piece of physical apparatus, and the human player certainly uses *his* brain for analysis, whether or not he uses some further spiritual equipment. Perhaps a better interpretation of the usual rule is that analysis must not be aided by equipment that is not a part of the human's organism or body. The storage of a computer can be categorized as internal or external only in a controversial manner. Magnetic core storage is most reasonably regarded as being *internal* to the 'body' of the computer; but a magnetic tape is a marginal case because it can either be hooked into the machine or it can be detached and kept on a shelf. If such detachable magnetic tapes were regarded as illegal, it would put a premium on some of the most up-to-date computers that have especially large internal storages.

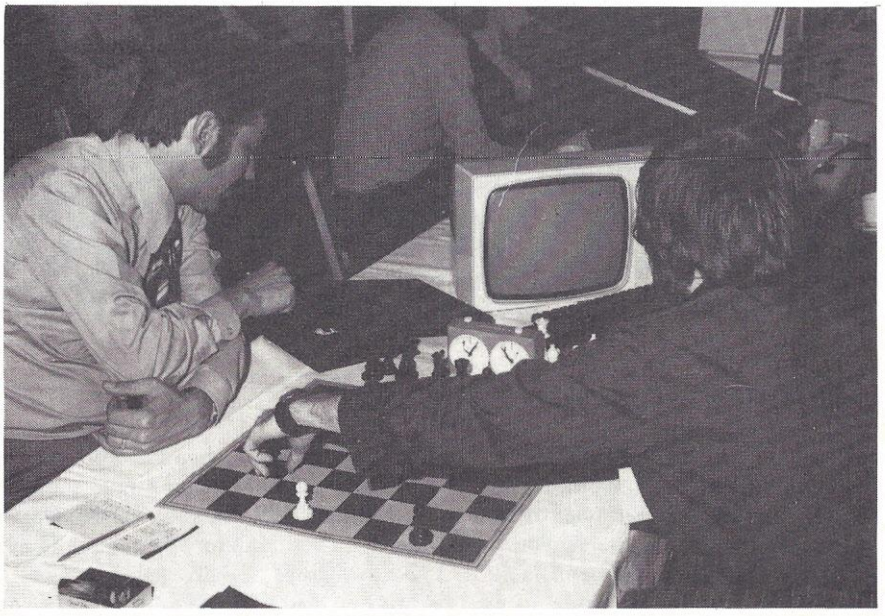
"The problem, if it is one, could be greatly alleviated by forbidding the storage of opening variations but this would give humans an unfair advantage. Therefore, if the rule is adopted, it would be useful to go over to 'randomized chess', as I have previously advocated both for ordinary chess (in *Chess, 17,* 1962, p. 161) and for computer chess (in 'A five-year plan for automatic chess', *Machine Intelligence 2*, 1967, page 115). As said in that article, a victory obtained by a computer because it stores 'the book' is a hollow victory because it contributes nothing to the science of artificial intelligence, and says very little about the ability of the people who wrote the chess program. A similar comment applies, though less severely, to *people* when they win by parrot knowledge of opening variations.

"This advocacy of randomized chess is a much more important point than the one this note is ostensibly about."

–IJG

Chess Chatter

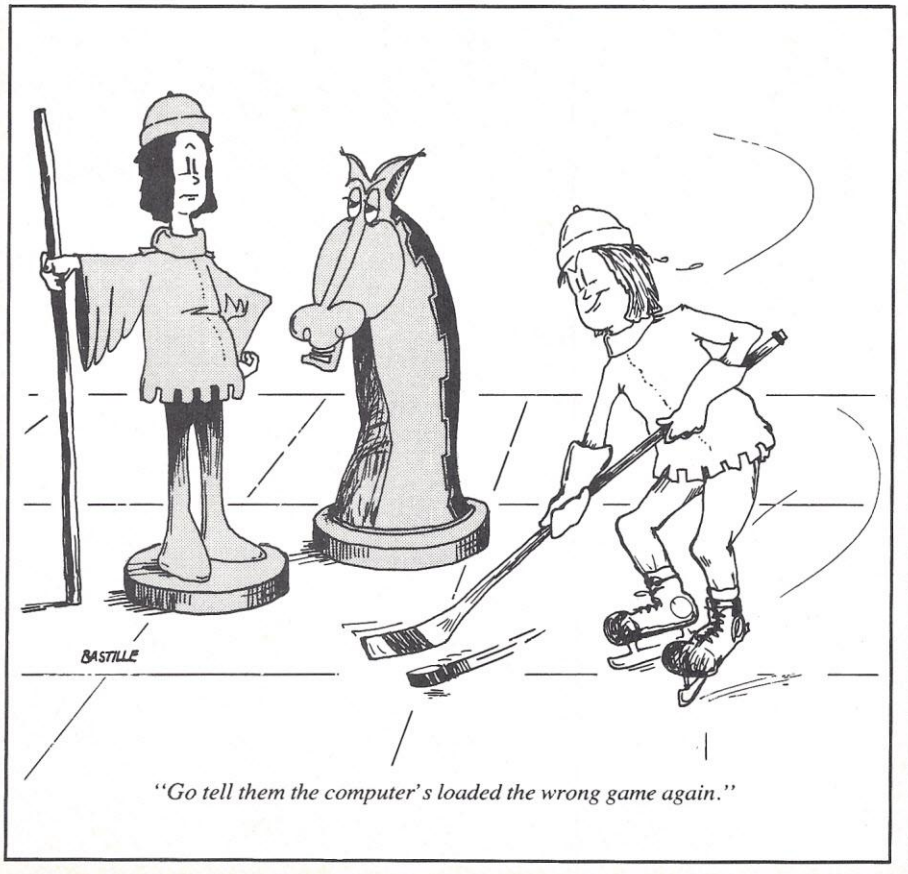
. . . PERSONAL COMPUTER WORLD, a microcomputer magazine published in London, recently sponsored the First European Microchess Championship Tournament. Some of the games played in that tournament will be upcoming in following issues. The participants in the tournament and the final standings are shown below. BORIS and MIKE finished in a tie for first place. "MIKE" and "FAFNER" refer to programs written by Mike Johnson and Hugh Fafner and were run on microcomputers. At the termination of the five-round tournament a playoff game was staged between BORIS and MIKE to determine a winner for the first prize of £200. Mike Johnson and his program MIKE emerged victorious in this playoff. . . Mike Johnson (back to camera in photo) plays against BORIS to determine winner of £200 at PCW's European Microchess Tournament in London. The program MIKE defeated BORIS in 39 moves. MIKE together with SARGON II, were the two microcomputer programs entered in ACM's Computer Chess Tournament, held in December in Washington. (Photo courtesy of PERSONAL COMPUTER WORLD).



	BOR	MIK	CC	MIC	FAF	COC	
BORIS	x	0	1	1	½	1	3½
MIKE	1	x	1	½	0	1	3½
CHESS CHALLENGER 10	0	0	x	1	1	1	3
MICROCHESS 2.0	0	½	0	x	1	1	2½
FAFNER	½	1	0	0	x	½	2
COCMA 5.0	0	0	0	0	½	x	½

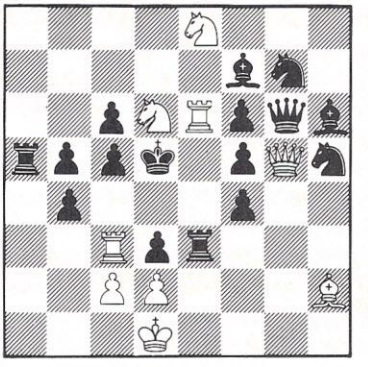
. . . Most companies, as a rule, are reluctant to reveal specific sales figures of their products, – an understandable shyness in competitive circles. Peter Jennings, however, of Microware Ltd., Canada, tells us that Microchess Casettes have sold in five figures just in the past few months. He tells us this not to crow about his sales charts, but more to point out the large amount of interest that is developing in microcomputer chess. . . **Doug Penrod, founder of "Computer-Chess Newsletter", died in December. Further information on that sad event will appear in Feb. issue** . . . Membership in the International Computer Chess Association (ICCA) is open to interested participants at an annual fee of $5. Write to ICCA, Vogelback Computing Center, Northwestern University, Evanston, IL 60201, USA. Professor Benjamin Mittman, editor of the newsletter, invites readers to send him computer-chess news of international significance.

. . . During the San Jose Microcomputer Chess Tournament in March of this year, Steve Stuart, of Mountain View, CA, drew more interest to his homemade entry than did other computers. "The design was almost 'cookbook', wrote Steve in a recent note. "I had planned for no sophisticated I/O at all and my metal box was a rather simple machine. The box was based on the Signetics 2650 microprocessor chip and included a calculator keyboard, 9-digit LED readout, and cassette tape interface. The keyboard and display were scanned in software which cut down on the logic. The tournament version of the machine had 2K of RAM and ¼K of ROM monitor. I have since changed the ROM contents and eliminated some switches and logic, while adding another 2K of RAM. My new version now runs a different chess program which is better than the one I had at the tournament, but still not quite as good as some commercial chess machines. Some cost breakdowns of that 'tournament' machine: I/O logic, $8.60; RAM, $28; CPU and logic, $49.29; and Hardware, $37,35. This came to a total of $123.24 but the actual cost to me was $87.40. Not included in the cost were such items as wiring, Vectorboard, a power supply (+5 volts @ 2 amps) and the cost of programming the monitor PROMS. My cost was less because I got many of the components free and dug others out of old circuit boards. The program does one ply of look-ahead, then relies on a position-scoring routine involving many chess-specific parameters. It seems that the more successful approaches emphasize look-ahead, so I am abandoning this machine and method of programming. I am beginning to work on another machine with much more memory, and probably using a Z80A microprocessor, and a hardware move generator to speed things up. This last feature, unfortunately, will disqualify it from micro-chess tournaments." Stuart's small 2K machine should have finished in last place by virtue of its tiny amount of memory. However, it gave the computer champion "Sargon" some stiff competition before losing in a mate on the 47th move; it beat the stronger Compucolor computer in a mate in 18 moves and managed a draw with second place finisher Commodore Chessmate. Chess Challenger and Processor Technology both beat Stuart.



"Go tell them the computer's loaded the wrong game again."

This end-game problem, reprinted by permission, appeared originally in "Puzzle Corner", a regular column in M.I.T.'s TECHNOLOGY REVIEW. Tech's "Puzzle Corner" is edited by Alan Gottlieb, Coordinator of Computer Mathematics, York College, Jamaica, NY 11451. Professor Gottlieb, together with a colleague, John Melchiori, have written a computer chess program called ALMA, which, says Alan, will eventually be entered in computer-chess tournaments.



Set up this month's position, as shown, in your computer and let White play to win. Can it do it? *(Really?)* How many moves? *(Is that so?)* Answer will appear next month. (Hint: a fairly intelligent chess player, who has just finished his second Vodka Martini and is puffing contentedly on his hand-carved briar pipe while waiting for his wife to announce dinner, can usually find a mate in six. After three drinks he does it in ten. Would like to hear from any program that can do it in less than six-with or without the Vodka.)

Computer Checkers

Burke Grandjean, secretary of American Checker Federation, differs with some of I.J. Good's observations regarding checkers (October issue): "Because any of five conditions can exist independently on each of 32 squares," observes Burke, "there are then 5^{32} checker positions (not 4^{32}). The figure for chess is correct: 13^{64}. The numbers of positions are astronomical in any case, so the quibble is minor. (These positions include all 'nonsense' positions like all pieces of the same color, 63 queens vs. a lone king, etc.) Professor Good says that the game of

checkers does not show examples of pattern recognition. However, pattern recognition is an absolute necessity to expert play. Expert checker-play also requires an ability to associate differing situations with those that have occurred in the player's experience - 'associative memory.' Among checker masters, games are rarely won because of an opening or mid-game advantage. Rather, the win comes from nursing a shadowy, razor-thin edge for 30 or 40 moves in the end game. Several of Professor Good's other comments indicate he has probably never studied checker games as played by checker masters like Tinsley and Hellman. Incidentally, Marion Tinsley, world checker champion, is still waiting patiently to hear from any good computer checker program willing to accept his stake-match challenge for a $5,000 purse."

Professor Arthur Samuel is currently associated with the Computer Science Department of Stanford University. In the early 1950's he worked at IBM's Research and Development Section. While there he wrote the first treatises on computer checkers in a series of papers titled "Some Studies in Machine Learnin Using The Game of Checkers." Now, at Stanford, Professor Samuel is involved in other fields of research including pattern recognition. He is working on Stanford's new "S-1" computer which is described as the world's most powerful computer, superior to the Cray machine. The "S-1" is a modular device consisting of 16 "concurrent" computers working together in a single array. He has hinted that when he gets a chance, and apart from his other duties, he plans to write a checker-program for the S-1. An interesting sidelight in computer-checker activity is the appearance of "Dr. Samuel's Checker Program" on the "Video-Brain" machine, which is a small typewriter-size keyboard of 36 character keys (with upper and lower sets of different characters) an internal interface to a cartridge-holding unit, and connectors leading to the home television set. The cartridge is like a small circuit board. Inserted in the unit it permits a user to play checkers through his own TV screen. Video Brain Computer Co., of Sunnyvale, CA., says Dr. Samuel's program, which can be run at different playing levels, is strong enough to give a good checker player a decent game and is selectable enough to enchant even a 7 year old beginner.

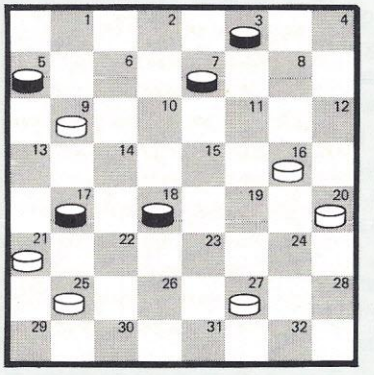
However, we are waiting Dick Fortman's analysis of this program before passing judgement on it. It sounds like an easy way to play computer checkers through a simple computer without having to buy an entire microcomputer system. The Video Brain, which sells for about $350 has about 20 other game-playing cartridges including the popular "Vice Versa" game (also known as "Othello".)

The following game was played by "Checker Challenger 10" at the last National Tourney. Playing in the Minor Division, the Challenger-10 drew five rounds and lost three, reports the ACF Bulletin. This fact suggests that the human checker player is a far more formidable opponent for the computer than is the human chess player. Professor Tinsley's $5000 wager (that no computer will be able to beat him in five years) seems pretty safe, at this time. The Challenger game was selected and annotated by Jules Leopold (JL) with added notes by Games Editor Dick Fortman (ACF's).

Black – **Checker Challenger-10**
White – **Human (Minor Division)**
(Black Moves First)

Black	White
1. 9-14	22-18
2. 6-9 (a)	25-22
3. 12-16	24-20
4. 8-12 (b)	28-24 (c)
5. 4-8	24-19
6. 10-15 (d)	19-10
7. 16-19	23-16
8. 12-19	26-23
9. 19-26	30-23
10. 9-13 (e)	18-9
11. 5-14	29-25 (f)
12. 2-6 (g)	32-28
13. 6-15	23-19
14. 15-24	28-19
15. 14-18	22-15
16. 11-18 (h)	31-26
17. 8-11 (i)	19-16 (j)
18. 11-15	26-23

After Blacks's 21st move



19. 13-17 (k)	23-14
20. 15-18	14-9
21. 1-5 (k)	21-14
22. 7-11	16-7
23. 3-17	9-6

24. 17-21 to a neat draw

Annotations

a) The same as 10-14, 22-18, 6-9 from the "3-Move Ballot" and very weak for Black (RLF)
b) Loses. The piece-down gambit with 16-19 is necessary, forming the "White Doctor" opening. But opening strategy like this would have to be pre-programmed into the computer. (RLF)
c) This may also win, but the published way is 27-24, stopping 4-8 with 18-15 (RLF)
d) Challenger-10 finds a combination that offers a stubborn defense. (JL)
e) Here 8-12 may well draw, but this exchange loses. (JL)
f) Obviously a miscalculation by White, as there is no waiting move if 2-6. Instead, 22-18 wins; Black can't recover. (JL)
g) Not at all intimidated, Challenger-10 recovers his man and White ruefully must exchange. (JL)
h) Once again, Challenger's piece is in jeopardy. (JL)
i) But the threat is neatly parried. (JL)
j) White does not fall for 26-23, then 11-15 and the piece on 25 is lost. (JL)
k) Nicely played. Although Challenger-10 has definite weaknesses in both opening and end-game play, it is capable of finding fine mid-game combinations at an expert level. (RLF)

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BOOKSHELF

Practical BASIC Programs

57 Practical Programs and Games in BASIC, Ken Tracton, editor; Tab Books, Blue Ridge Summit, PA 17214; $10.95 hardbound, $7.95 paperback.

I can hear it now – "Not another collection of BASIC programs". Well, you're at least partially right – games written in BASIC abound these days and you don't have to look far to find six different versions of the same game. With the number of BASIC games about to reach the saturation point, what makes this book worth your consideration? Only eight of the fifty-seven varieties included in the book are games – the remaining forty-nine might be best termed "scientific subroutines". They are a cross-section of routines that would be at home in a larger scientific type of program. Included are a Chi-Square evaluation, instant derivatives, generalized mean, prime number test, vector cross product and inverse hyperbolic functions. Only two programs slant towards accounting so the scientific flavor tends to permeate the book.

The book is well laid out with a description of the BASIC vocabulary and syntax used by the author in these programs. Each program has a flow chart, a brief description of what the program does, any formulas used by the program and a sample run to illustrate the program's input and output, as well as the actual program listing. According to the author, the programs were written to run on an IBM 370-158 time sharing system. Unfortunately, not many people involved in personal computing these days have access to a machine of that size. I would have preferred that the programs been written and tested on something more "micro-minded", but the actual coding of each program avoids any specialized machine-dependent BASIC instructions and should run with minor modifications on any simplified subset of BASIC equipped with floating point.

Most programs are less than 30 lines with a few reaching 80. By far the longest program in the book is STAR WARS – extending some 287 lines. A shorter STAR WARS is also included which only runs 133 lines. Both are adaptations of the classic STAR TREK game with changes to accomodate the different characters and weapons of the *Star Wars* movie.

The games are generally abbreviated versions of the old standbys – craps, blackjack, a number guessing game – except for one. I CHING (The Chinese Book of Changes) is one game that I haven't seen implemented before. This particular version only outputs the hexagrams corresponding to your inputs and requires you to have a copy of "The Chinese Book of Changes" handy. A more novel output would really have been to print out the user's fortune in plain English, rather than cryptic hexagrams.

Just how practical you'll find this book depends on where your interests lie. If you're writing BASIC programs which require some fancy math functions, this book may just fill that empty slot on your bookshelf. But if you're looking for games, your $7.95 would be better spent elsewhere.

– Reviewed by J. B. Ellmer

Understanding Digital Electronics; Texas Instruments Inc., P.O. Box 3640, M.S. 84, Dallas, TX 75285; 265 pages; $3.95 softback. *Understanding Calculator Math;* 225 pages; $3.95 softback.

These new additions to the TI Learning Center Library represent the start of a planned "Understanding Series" of electronics books from TI. *Understanding Digital Electronics* explains the digital system, electronic devices and circuits. *Understanding Calculator Math* covers formulas and mathematics tools needed in the use of a calculator.

Mini-Micro Soldering and Wire Wrapping, by Murray P. Rosenthal; Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662; 120 pages; $3.95 paperback.

This book includes full explanations of electronic soldering/desoldering and wire wrapping, from simple components to more complex breadboarding. The fastening together of individual electronic components and their removal during repair and troubleshooting is discussed, along with necessary tools. Covered in four chapters are bulk soldering techniques, how to solder new circuits, how to desolder/resolder existing circuits and some basic techniques for troubleshooting and repairing various types of electronic equipment.

Home Computer Systems Handbook, by Sol Libes; Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662; 208 pages; $8.45 paperback.

A new primer written specifically for newcomers to the home computer field, this book emphasizes important practical knowledge that home computer users should have to purchase, assemble, interconnect and program microcomputers intelligently. The guide provides necessary background in digital logic fundamentals, number systems and computer hardware and software basics. Only a minimal knowledge of electronics is required. Further, the book offers an introduction to programming on the machine level and with higher level languages such as BASIC. Also various applications for personal computers are described, such as maintaining financial records, storing records, controlling appliances, typewriting, sales analysis and inventory control.

BASIC From the Ground Up, by David E. Simon; Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662; 232 pages; $8.95 paperback.

This introduction to BASIC assumes you know nothing about computers. It requires only a minimal knowledge

of algebra and is written with a light touch. All the statements of BASIC are detailed, not just the essential ones, as well as what actually goes on inside the computer when you are programming. The book covers one version of each of the BASIC statements with some of their variations, preparing you to write programs in any version you encounter. Exercises and problems round out the book.

The Mind Appliance: Home Computer Applications, by T.G. Lewis; Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662; 144 pages; $6.95 paperback.

The serious computer hobbyist who has tired of playing games now can advance to the household appliance computer with this new guide for applying the personal computer to home use. Your computer will write poetry, balance a checkbook, score musicals, automatically dial a telephone and draw graphics. These and many other uses, such as handling household budgets, menu planning and income tax calculations, are illustrated with actual programs that can be put to immediate use.

6800 Assembly Language Programming, by Adam Osborne and Associates; Adam Osborne and Associates, P.O. Box 2036, Berkeley, CA 94702; $8.50.

Assembly language has been widely used by microcomputer hobbyists and engineers for some time. Yet, while there have been many fine textbooks introducing the principles and uses of BASIC, Osborne & Associates feel no equivalent text has existed for assembly language. For this reason, they have just released their latest book, *6800 Assembly Language Programming.*

The book is for those interested in using assembly language to program their microcomputers. It is an assembly language primer in the classical sense. The book is a clear and understandable textbook for microcomputer users who have little or no knowledge of assembly language and who desire to learn. And it is also a reference book for people already programming with assembly language.

Getting Acquainted with Microcomputers, by Louis E. Frenzel, 288 pp., $8.95; softback; *Z-80 Microcomputer Handbook,* by William Barden, Jr., 304 pp., $8.95; softback; *Using the 6800 Microprocessor,* by Elmer Poe, 176 pp., $6.95; Howard W. Sams & Co., Inc.; 4300 West 62nd Street, Indianapolis, IN 46206.

The first of these new offerings from Howard W. Sams & Co., Inc., an introduction to microcomputers, includes discussions on basic concepts, definitions, organization, architecture and operation. A "how to" chapter describes the building of a microcomputer learning laboratory. Software, programming fundamentals and hobby and personal computing are also covered.

The *Z-80 Microcomputer Handbook* is organized into three sections, covering hardware, software and microcomputers built around the Z-80. Current users and prospective buyers may find useful information on Z-80 technology in this handbook.

Using the 6800 Microprocessor acquaints the reader with 6800 hardware and software and guides the reader through the conception, configuration, writing and running of a variety of programs demonstrating the use of a 6800 system.

Personal Computers for the Businessman; Management Information Corporation; 140 Barclay Center, Cherry Hill, NJ 08034; (609) 428-1020; 8½ X 11"; 28 pp.; $7.50; paperback.

This brief introduction to personal computers is written for businessmen with no knowledge of the field. The authors devote four pages to the fundamentals of microcomputer hardware and software, and another three pages to shopping strategies. A two-page glossary includes the most common computer terms.

The book also features brief looks at 14 representative microcomputer systems, including Apple, PET, Compal, Imsai, Altair and Radio Shack. The book's most valuable feature, however, is a five-page list of hardware manufacturers and suppliers and software sources.

The User's Guide to North Star BASIC, by Robert R. Rogers; Interactive Computers; 7620 Dashwood, Houston, TX 77036; (713) 772-5257; 200 + pp.

Interactive Computers' first entry into the publishing field is a book by a microbiologist who, without any prior knowledge of computers or the BASIC language, has painstakingly chronicled his learning expriences from "start-up" to useful, practical programs.

The *User's Guide to North Star Basic* is not meant to be a technical manual; it's a beginners book written by a beginner. The book takes a step-by-step approach, with discussion and examples in each of thirty-six major topics. Included are a number of programs for games, teaching and business written to demonstrate particular programming techniques.

The Cheap Video Cookbook, by Don Lancaster; Howard W. Sams & Co., Inc.; 4300 West 62nd Street, Indianapolis, IN 46206; (317) 298-5400; 5½ x 8½"; 288 pp., $5.95; softback.

Here is a low-cost way to get words, pictures and op-code out of a computer and onto an ordinary TV set with minimum modifications to either. You'll find do-it-yourself nuts-and-bolts construction details with documented and debugged support software.

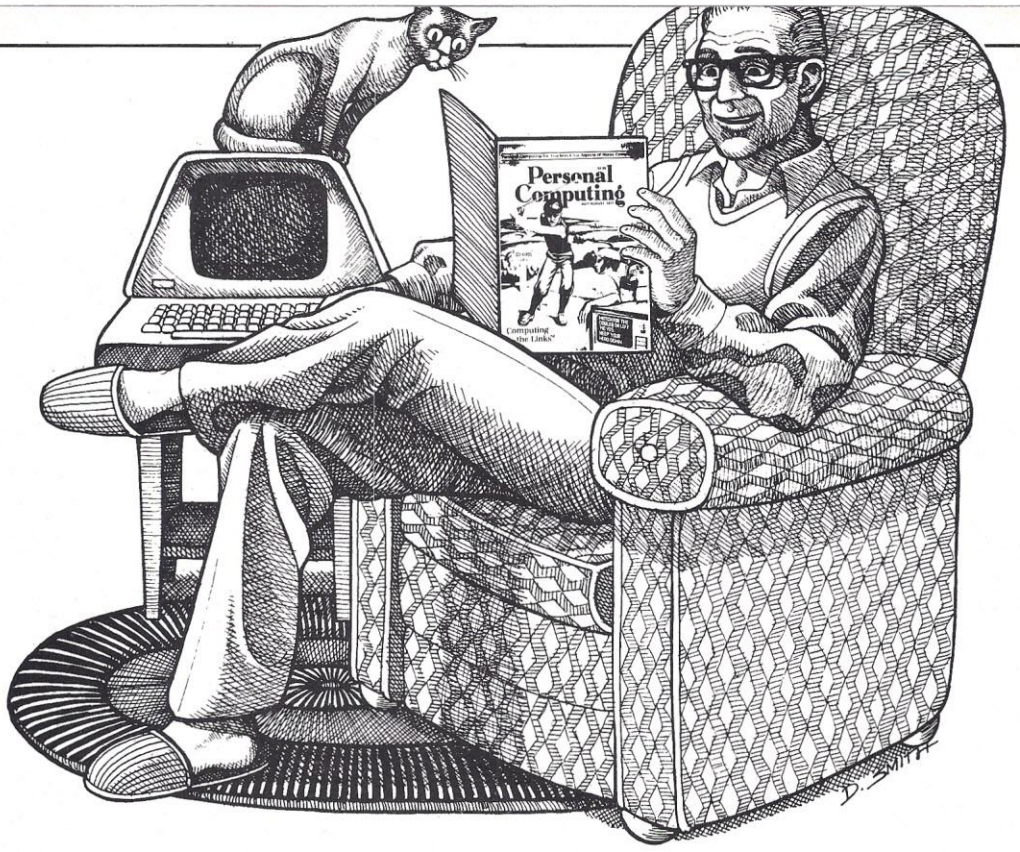
The first chapter begins with the basics of alphanumeric and graphics video display systems. The second chapter shows you how to design cheap video software.

Hardware is presented in Chapter 3. The interface circuitry you will need between your computer and TV set is introduced on a block-by-block basis.

Construction and debug details of the TVT 6-5/8 follow in Chapter 4, along with details of four modules that program your TVT 6-5/8 for upper- and lower-case alphanumerics and high-resolution and color graphics.

Covered last are transparency techniques that let you compute and display at the same time while keeping high throughput.

The appendix gives you IC pinouts, ASCII coding, and a number conversion chart.



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PERIPHERALS

Mindless Terminal from Vector Graphic

Mindless Terminal for small business computer system users has been introduced by Vector Graphic Inc. Compatible with S-100 bus microcomputers, the low-cost terminal accepts separate TTL video and sync, and interfaces with most existing alphanumeric video display boards.

Word processing applications used with Vector Graphic's Flashwriter video board include instantaneous positioning of the cursor, split screen copy, instant copy access, upper/lower case lettering and line justification. The terminal also offers a monitor projecting character-by-character reversed video, reduced intensity, and block and line graphics for a host of new applications.

The terminal with flashwriter video is a full 16 x 64 display on a 12" screen. It offers 900-line resolution at center and 750-line resolution at the borders.

Price for the Mindless Terminal is $765. The unit may be purchased at Vector Graphic dealers. For more information, contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361; (213) 991-2302. *Circle No. 179.*

Semi-Intelligent Terminal Brochure

Computer users upgrading their video display terminal can obtain a brochure on a new semi-intelligent CRT from Lear Siegler, Inc.

The ADM-42 provides flexibility of format, security, editing, interface and transmission, according to the pamphlet. ADM-42 features a full two-page display as standard equipment. Two 1920 character pages of memory are optionally expandable to eight pages.

Other special capabilities of the ADM-42, described in the literature, include 16 function keys for 32 separate commands; incremental cursor positioning from the keyboard or a remote computer; blanking/underline, blinking and reverse fields; and a field protect mode preventing data from being typed over or overwritten by the operator or remote computer.

The terminal's behavior modification feature is factory preprogrammed for compatibility with many industry standard computer systems. Parameters such as an alternate ESC sequence lead-in, end block character, new line character sequence, field separator and a function sequence preamble can be changed from the keyboard or computer to conform with the user's specific system or systems.

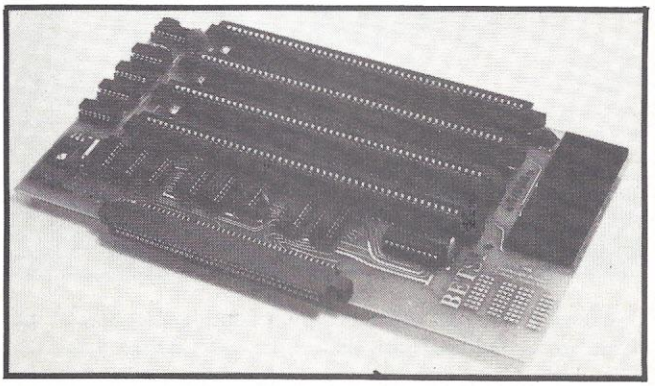
Additionally, the terminal offers three methods of tabulation: a protect mode that tabs to the first unprotected space; a modulo tab where the modulus may be any number from one to 79; and a columnar tab equivalent to that on a typewriter.

For further information contact Lear Siegler, Inc./Data Products Division, 714 N. Brookhurst, Anaheim, CA 92803; toll free (800) 854-3805; in CA (714) 774-1010. *Circle No. 192.*

S-100 Expansion for PET

Forethought Products has announced their PET to S-100 Interface/Motherboard "Betsi".

Betsi is a single circuit board that contains all the necessary logic to interface S-100 type boards to the PET. Unlike other interfaces which require the addition of external chassis, S-100 backplanes or special cable assemblies, Betsi attaches directly to PET's memory expansion connector and provides both interface logic and four S-100 slots on a single compact circuit board. Betsi operates with any S-100 power supply and doesn't interfere with use of PET's parallel or IEEE ports.



In addition to its compatibility with most available S-100 boards, Betsi features an on-board dynamic memory controller. This controller, which allows PET/Betsi to use the S.D. Sales Expandoram memory board, means that PET's memory can be expanded to the limit (32K) with a single S-100 card.

On-board features include sockets and decoding circuitry

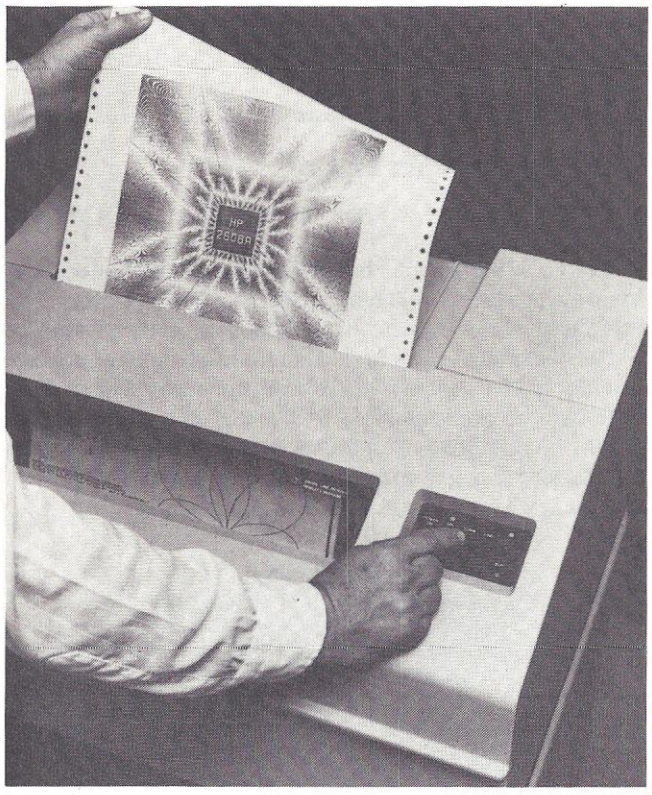
for 8K of PROM memory (2716). Future PET software in PROM will plug directly into Betsi with no additional hardware needed.

Betsi is currently available from stock in either kit or assembled form. All parts and full documentation are included, at $119 kit (includes one S-100 connector) and $165 assembled and tested (includes four S-100 connectors). For more information contact Forethought Products, PO Box 8066, Coburg, OR 97401; (503) 485-8575. *Circle No. 194.*

Printer Products from HP

Three printing products have been introduced by Hewlett-Packard. A new dot-matrix, 400-lpm line printer, 2608A, uses well-established technology in a frictionless print mechanism under the control of a microprocessor that provides self-diagnostics, improves operating speed and makes possible a great variety of character and graphic print modes.

The HP 2608A can be programmed to produce characters to double normal size. As many as 16 different character sets can reside within the printer, and any two may be used within any line. The standard set is 128-character USASCII. Options include Cyrillic, Katakana, APL and most European sets.



The HP 2608A, under program control, can plot at high speed any graphic display that can be described by a matrix of dots with a density of 781 dots per square centimeter (5040 dots per square inch). These are placed with 0.03-mm (0.014-inch) accuracy, yet a 30-cm (12-inch) page can be printed in less than 20 seconds. The possibilities include diagrams, graphs, subscripted and superscripted print, super-size print, labels at any angle and decorative effects.

Forms of as many as six parts may be printed on the 2608A. Forms control is enhanced by a 16-channel, totally-electronic programmable vertical format control (VFC). The user can select the standard ROM-resident channel assignments, called up automatically when the machine powers up, or define any other desired formats, including form lengths of as many as 127 lines, by programming the VFC on the computer. US price of the HP 2608A Impact Line Printer is $9250. Sound cover is $150.

Another printer, a 180-character-per-second, dot-matrix impact printing terminal, is available in a new version, the HP 2639A, with a flexible serial interface that enables it to handle many different communications protocols, so it is readily applicable to many different computer systems.

The printing versatility of the 2639A makes it a desirable fit in many uses. Three different print sizes are program-selectable; five characters per inch is available for headings

or title, 10 cps is for normal print, and 16.7 cps makes it possible to print 132 columns on 8-1/2"-wide paper or 227 columns on 14-7/8" paper. Line spacing is also programmably selectable at one, two, three, four, six, eight, or twelve lines per inch to print a wide variety of forms and to print superscripts or subscripts. Adjustable forms tractors allow use of forms as wide as 400 mm (15.748 inches). Forms may be 6-part paper (up to 12 lb. bond with 7 lb. carbon interleaved). A full 128-character ASCII set is standard with characters formed by a 7 wide by 9 high matrix. This allows for true underlining, lower case descenders, and clearly-formed characters for excellent readability. US list price of the 2639A is $4025.

The third printer, a new graphics model, produces hard copy on standard paper from any raster-format display on an HP 2647 or 2648 CRT graphics terminal. Resolution is 72 x 72 dots per inch. In addition, the new HP 2631G is also a versatile alphanumeric printer that accepts ASCII data and prints at 180 characters per second, like all other members of the HP 2631 family.

Graphics print speed is increased with a double buffering technique, by which the 2631G can accept graphics data while simultaneously printing. The hard copy is non-fading and multiple-part paper may be used. Applications are expected in business, science and engineering.

The new HP 2631G Graphics Terminal shares all the alphanumeric capabilities of the HP 2631A, upon which it is based. Its SOS microprocessor computes the shortest printing path, deletes all leading and trailing blanks, and skips at high

speed over ten or more imbedded blanks. Horizontal tabs are similarly speeded. These features optimize the throughput of the 2631G without taxing the host CPU. Special forms of up to six parts with carbon interleaved may be printed. Forms may be as wide as 15.75 inches and any length (up to 255 lines). Four print sizes are program selectable, 5 characters per inch and 7.2 characters per inch for normal typewriter size test. Compressed printing at 14.4 characters per inch allows 196 columns on standard computer paper. US price of

the HP 2631G is $4250. It comes with an HP-IB (IEEE 488-1975) interface and operates with HP's 2647A and 2648A graphics CRTs.

For information contact Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Road, Palo Alto, CA 04304; (415) 856-1501. *Circle No. 191.*

TRS-232 Interface from Small Systems Software

The TRS-232 interface is a software-driven, transmit-only device that plugs directly into the TRS-80 CPU box or the TRS-80 expansion interface. It gives TRS-80 owners the power to have low cost hard copy using a reconditioned daisywheel printer.

The interface sells for $39.95 and may be purchased from COMPUTER TEXTile. For more information contact COMPUTER TEXTile, 10960 Wilshire Blvd., Suite 1504, Los Angeles, CA 90024; (213) 477-2196. *Circle No. 187.*

Bantam CRT from Perkin-Elmer

A full-function CRT terminal has been introduced by the Perkin-Elmer Corporation. The compact CRT, called the BANTAM, is priced at $599 in quantities of 100.

BANTAM is designed for hectic office environments and offers human-engineering features that speed data entry and reduce operator fatigue, according to the company. One feature of the CRT is its fourth generation custom LSI chip which is both microprocessor and controller.

BANTAM offers a full upper and lower case character set, a high density 7 x 10 character matrix, a 24 line by 80 character display, a full, typewriter-like keyboard with a shadow numeric pad and a built-in self-test feature to improve maintainability. Complete tabbing, full cursor addressing, and repeat, backspace, shiftlock and separate print keys are standard.

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Eleven asynchronous data rates from 110 to 9600 baud are externally selectable. BANTAM's EIA standard RS232C interface provides ASR 33 compatibility. The CRT's display is set deep in the hood to reduce glare and can be switched from a white-on-black to a black-on-white display to suit the operator's preference. The high density dot matrix produces highly legible characters with well-defined descenders. A wide bandwidth monitor assures sharp images everywhere on the screen. the cursor frames the entire character position in a transparent, inverted video block.

BANTAM weighs 28 pounds and measures 15" x 19" x 14". Options include a full overstrike APL model, a range of foreign language character sets, a low cost PUSSYCAT page printer, a current loop interface and a RS232C printer port. For further information contact Perkin-Elmer, Randolph Park West, Route 10 & Emery Avenue, Randolph, NJ 07801; (800) 731-2154. *Circle No. 184.*

Professional Encoded Remote Keyboard

George Risk Industries has announced PERK, the Professional Encoded Remote Keyboard, for the Commodore PET personal computer. PERK, a plug-in, full typewriter-style alphanumeric keyboard,is designed to enhance the operation of the PET. Although supplied with a built-in calculator-type keyboard, the PET keyboard is only half the size of standard typewriter keys and the non-standard, block layout makes touchtyping impossible. The PERK keyboard shares the PET internal keyboard interface, allowing the two keyboards to be used interchangeably. Both are active at all times, allowing the operator to use the external keyboard for normal data entry, and the built-in keyboard for numerics or for utilizing the PET's graphic capabilities.

The PERK keyboard is housed in a custom steel desktop enclosure, and is connected to the PET by a plug-in interface card. Once installed, the remote keyboard is immediately useable on all existing software. No changes or modifications are required, and both internal and external keyboards may be used simultaneously without modification.

In addition to standard upper-and-lower case alpha characters, with proper shifting, the PERK keyboard alpha-lock allows easy entry of upper-case-only, or TTY mode operation. Also, standard CRT terminal control functions are implemented for cursor control, and full screen editing capabilities are provided. More than one remote keyboard may be attached to a single PET computer for multiple operator data entry.

Introductory price is $299.95, wired and tested. For further information, contact George Risk Industries, Inc., GRI Plaza, Kimball, NB 69145; (308) 235-4645. *Circle No. 189.*

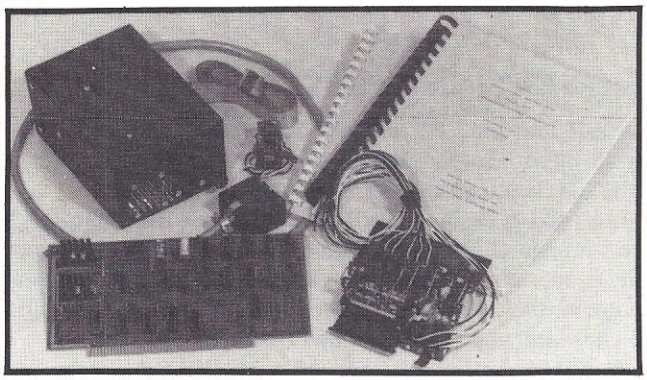
Qume Spring 5 Daisywheel Terminals

Computer Textile has announced it is now carrying the new Qume Sprint 5 line of daisywheel printing terminals and accessories. The Sprint 5 is available in both 45 and 55 CPS versions, both with and without keyboards. Each Sprint 5 model provides high quality word-processing and plotting printouts. Over 50 different daisywheel type fonts are available.

For more information contact Computer Textile, 10960 Wilshire Blvd., Suite 1504, Los Angeles, CA 90024; (213) 477-2196. *Circle No. 197.*

Universal Interface Unit for IBM Selectric

ESCON has announced the development of a universal interface unit for its IBM selectric typewriter conversion system. The present unit allows any microcomputer with an S-100 bus to output to an IBM selectric typewriter. The new unit will interface to any RS-232, IEEE-488 or parallel port. A microprocessor is included on the circuit board for data flow control, formatting and character set selection.



The installation on the selectric does not affect normal typewriter operation. For those who do not want to convert their own typewriter ESCON provides factory installation service or can recommend local qualified computer stores throughout the US. Selectric typewriters with conversion systems installed in accordance with factory instructions are

still eligible for IBM warranty and service provisions. For further information contact ESCON Products, Inc., 171 Mayhew Way, Suite 204, Pleasant Hill, CA 94596; (415) 935-4590. *Circle No. 178.*

Intelligent 9600 bps Modem from Infotron

Infotron Systems Corporation has introduced the DL 9600, a new microprocessor-controlled 9600 bps modem. The design of the automatic equalization unit permits it to withstand line transients lasting up to two seconds without retraining.

The LSI unit operates point-to-point in a full duplex mode on a four wire 3002 private line at 4800 or 9600 bps, switch selectable. All digital filters eliminate the drift found on analog units and provide an error rate of less than one bit in 10^6 at 9600 bps on an unconditioned line with a signal to noise ratio of 22db.

The DL 9600 features optional dial back-up and extensive self testing capabilities including digital or analog loopback of remote unattended units. The operator can perform both local and system diagnostics and can select all mark or all space transmission. There are four front panel switches and

nine LED indicators including one to signal that the telephone line is degrading.

Conservative application of LSI technology has produced a modem with low power consumption and reliability in a compact 3.5" high by 17.5" deep rack mount or tabletop package. The DL 9600 is priced at $5500 in unit quantities. For further information contact Tony Barbaro, Vice President, Sales and Marketing, Infotron Systems Corp., Cherry Hill Industrial Ctr., Cherry Hill, NJ 08003; (609) 424-9400. *Circle No. 186.*

Digital DECwriter Series Expanded

Digital Equipment Corporation has added three models to its DECwriter line of terminal printers. The hard-copy terminals consist of the DECwriter III and the company's first table-top terminals, the DECwriter IV series.

According to Edward A. Kramer, vice president of the Digital Components Group, the new terminals extend both the price range and flexibility of the DECwriter line, doubling the number of hard-copy DECwriter models available. The DECwriter family now extends from the $1450 entry-level DECwriter IV through the $2600 top-of-the-line DECwriter III.

The new DECwriter III will be designated model LA120; deliveries are scheduled for January. Unit prices in quantity

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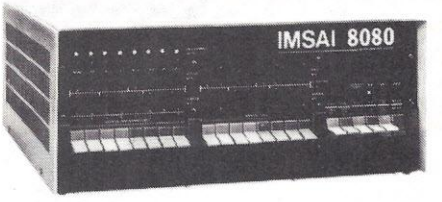

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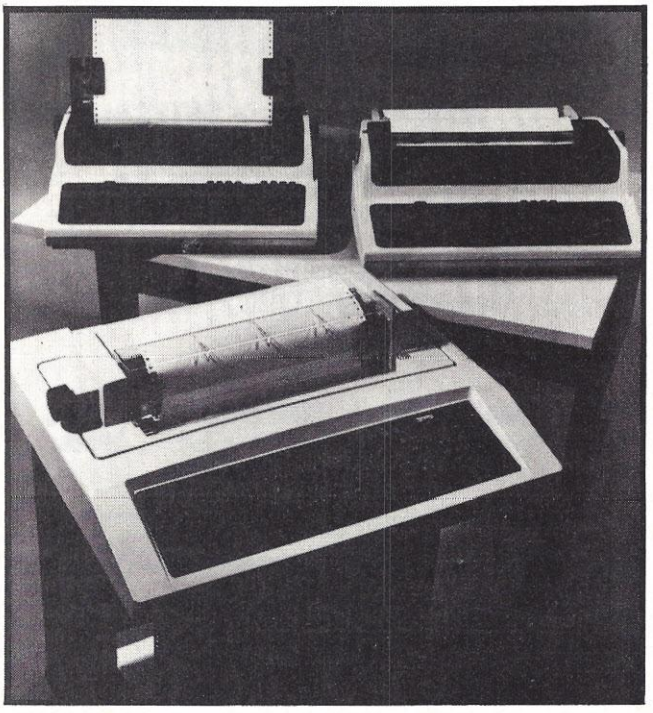
of 100 are $1830. The entry-level LA34 DECwriter IV is Digital's first terminal to employ a rubber platen (roller) similar to those found on office typewriters and to accept rolltype printout paper or individual sheets. It is priced at $1450, with first deliveries scheduled on Digital systems for late spring. The company plans to sell the LA34 DECwriter IV in high volume at minimum quantities of 50. Prices in 100-unit quantity are $975.



Kramer said, "The new 30-character-per-second DECwriter IVs are designed for applictions requiring a low cost, low to medium speed hard-copy terminal."

Kramer anticipates the DECwriter IV series will find wide acceptance by commercial users. "The DECwriter IV has been created for work in a normal business office. Its basic operation and appearance are very similar to an electric typewriter — even though it is far more flexible. It is the quietest of our printing terminals, has a contoured keyboard for easier typing, and even has a snap-in cartridge for easy ribbon changing. We found that anyone who has experience typing has no difficulty working with the DECwriter IV right away," Kramer said.

The DECwriter IV can be used in virtually any application requiring a serial asynchronous ASCII terminal. Both the LA34 and LA38 employ a 9 x 7 dot-matrix character output in upper and lower case. Any of four character sizes can be selected by the user, including a compressed font with a density of 216 characters per computer-form line. Using this compressed font, a full 132 characters can fit on an 8-1/2 inch wide piece of paper.

The DECwriter IV's output rate of 30 characters per second is maintained through use of a buffer that stores characters being received by the terminal while it is executing a carriage return. A special burst mode causes the print head to accelerate its print rate until it has caught up with the transmission.

A special-purpose microprocessor permits the user to select such functions as type font, tabs and margins by using a set up key. Settings can also be made from the computer connected to the terminal, if desired by the user, through programmed commands.

The new DECwriter III, with more than 45 selectable features, is intended for use as a console terminal for standalone and timesharing computer systems. It is particularly suitable, the company said, for those applications where a high degree of interaction between the user and the computer system is anticipated. It is also suitable for upgrading computer networks from 300 to 1200 baud, both to increase productivity and operating speed and to reduce communication line charges. Mr. Kramer noted that the DECwriter III is designed for applications requiring a high rate of data transfer and/or a high degree of interaction between computer system and user.

The DECwriter III also employs a special-purpose microprocessor for selection of features, either via the keyboard or under program control. The LA120 is a bidirectional-printing terminal, with logic moving the print head to the margin closest to its position after it completes a line. It has a 1K-character buffer and logic to permit it to skip quickly over areas not requiring printing (or "white space"). As a result, the LA120 will accept data with a 1200-baud output.

The new DECwriter III offers a choice of eight font sizes, from five characters per inch to 16.5. In the compressed-font style, the LA120 can print across the entire width of a 14-7/8 inch computer form, a 216-column output. The user can specify six different line spacings.

Although intended for use primarily in 1200-baud applications, the LA120 can communicate at baud rates from 50 to 9600 BPS. A pedestal-mount terminal, the new DECwriter III employs an EIA RS-232 interface as standard.

For more information contact Digital Equipment Corp., Maynard, MA 01754. *Circle No. 205.*

EAS Disk Drive System

The EAS disk system from Electro Analytic Systems, Inc., consists of two full-size, 8" Shugart drives and Tarbell controller capable of handling up to four drives, as well as power supply, interface, all cables, cooling fan, aluminum chassis and wooden cabinet.

Storage capacity is a quarter of a million bytes per drive, a total of a half million bytes per system, 3.3 kilobytes per trace, 8 ms track to track access time, and 211 ms average access time (including settling).

Electro Analytic Systems, Inc. offers a 90-day parts and workmanship warranty. Dealer inquiries are invited.

The DOS software recommended and available separately from EAS is Digital Research's CP/M assembler, text editor and debugger, with EAS I/O handlers (BIOS) together with powerful utilities.

The EAS Disk Drive System is S-100, A-80, 8080 and IBM compatible and can be purchased with or without controller. For more information contact Electro Analytic Systems, Inc., P.O. Box 102, Ledgewood, NJ 07852; (201) 584-8284. *Circle No. 195.*

Terminal System

Southwest Technical Products has announced a new terminal system. This SWTPC engineered product is functional, flexible, reliable and affordable. The terminal, designated the CT-82, will work with almost any modem or computer system interfaced RS-232 serially from 50 thru 38,400 baud.

The CT-82 features over one hundred control functions operable from either the CT-82's keyboard or the computer's program. With its low price and graphics capability, it's suitable for business or hobby use.

The terminal design utilizes a Motorola 6802 microprocessor and 6845 CRT controller integrated into a modular system.

The CT-82 is offered in assembled form only and sells for $795 ppd. in the Continental U.S. For more information contact Southwest Technical Products Corporation, 219 W. Rhapsody, San Antonio, TX 78216; (512) 344-0241. *Circle No. 193.*

High Speed Graphics Display Systems

A new series of high speed, high resolution interactive graphics display systems that interface to many popular computers, freeing the host of grapics computational burdens, has been introduced by ADAGE, Inc.

The ADAGE 4100 Family is a line of interactive graphics peripherals featuring a 56-bit microprogrammed graphics processor with a high speed control store memory to permit displays of over 23,000 dynamic vectors flicker free. The 2-D Models 4115 and 4125, and the 3-D Model 4135 contain firmware in ROM control store memory; the 3-D Model 4145 contains a RAM control store that allows users to develop custom applications firmware.

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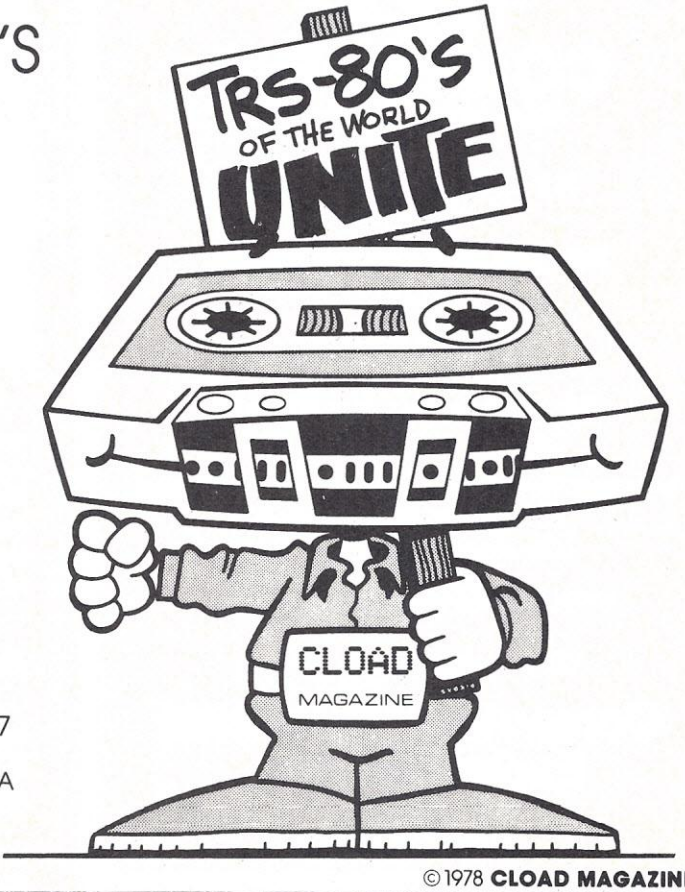

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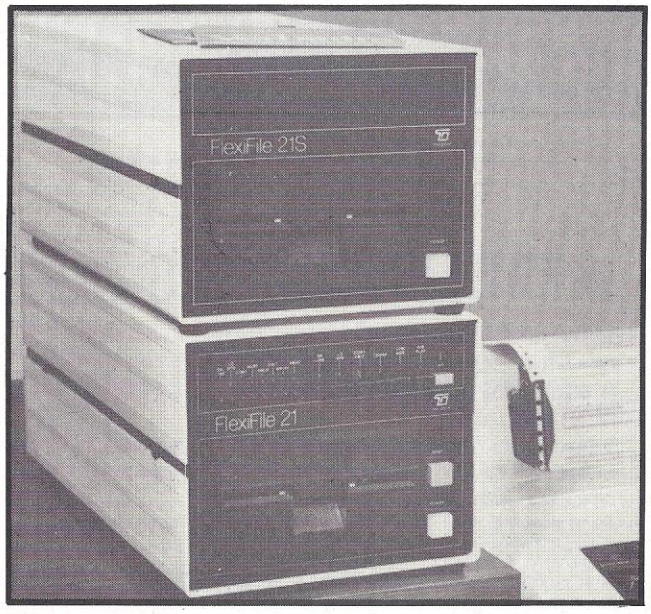
4100 Family can support up to 4 fully interactive consoles. Graphics processor options include 128:1 zoom, programmable hardware window, circle arc generator, 3-D depth cueing and image buffer up to 128K bytes. Display console options include alphanumeric keyboard, 32 programmable lighted function switches, light pen, joy stick, data tablet and color monitor (monochrome monitor is standard). For more information contact ADAGE, Inc., Chuck Hafemann, Director of Marketing Services, 1079 Commonwealth Avenue, Boston, MA 02215; (617) 783-1100, Ext. 332. *Circle No. 190.*

Dual Drive FlexiFile 21

Tri-Data has announced the availability of dual drive version of the FlexiFile 21, a mini-flexible disk system with widespread application. Because it is microprocessor based, the unit is fully programmable and allows the user to completely change its operation in a few seconds by simply loading a new program. The slave drive is controlled from the master drive and can be easily added to an existing unit.



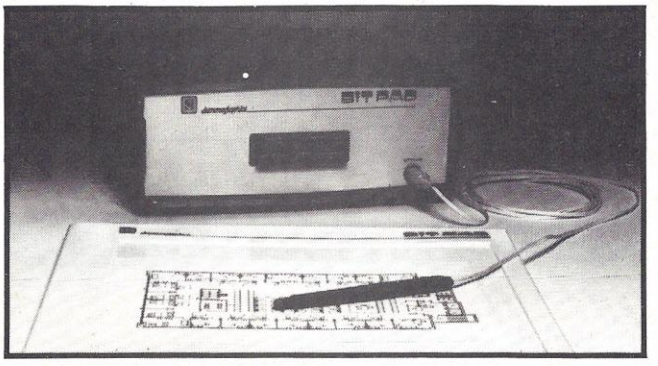
The FlexiFile 21 single drive unit sells for $1995 and includes an RS232 interface and 8K of random access memory, expandable to 12K. The second drive is an additional $800. For more information contact Richard Hlava Vice-President of Marketing, Tri-Data, 800 Maude Avenue, Mountain View, CA 94043; (415) 969-3700. *Circle No. 183.*

TRS-80 Interface from Summagraphics

Summagraphics Corporation has announced an interface for the company's digitizer, the Bit Pad, to the Radio Shack TRS-80 microcomputer. This new interface permits entry applications from the Bit Pad to the TRS-80.

The interface, priced at $175, includes a cassette enabling the user easy loading of the operating program to permit transfer of data. Data is transferred from the Bit Pad as five

8-bit bytes. The interface is contained in a small separate box that readily connects to both the Bit Pad and the TRS-80. The interface allows use of all other TRS-80 accessories.



For more information contact Summagraphics Corporation; (203) 384-1344. *Circle No. 196.*

Synchronous Modem

Gandalf Data Inc. has released product literature on the Model LDS 309 Synchronous Modem. LDS 309 transmits data at speeds up to 19,200 bps and conforms at all speeds including 19,200 bps to Bell Publication 43401. Advantages include simple installation without the need of an oscilloscope, artificial line for self-test, phase lock loop, data scrambler and local and remote digital loop back. For more information contact Gandalf Data, Inc., 1019 South Noel, Wheeling, IL 60090; (312) 541-6060. *Circle No. 188.*

Touch Screen Terminal System

Megadata has introduced its new Touch Screen Terminal System (700/TS). The 700/TS provides a whole new dimension in man/machine interaction. Totally untrained personnel can walk up to the terminal and make full use of a complex computer system. Applications for the Touch Screen Terminal include such areas as executive data base interaction, education, medical diagnosis, voter registration, bank customer service and air traffic control.

Touch Screen operation is accomplished by a process termed Echo Surface Wave Ratio (ESWR), which operates on the same principle as radar and sonar. The amount of information displayed by the touch screen is up to 80 characters per line by 24 lines. The 15-inch diagonal display area provides a touch resolution of 1920 pads. The number of pads is strictly a function of the size of the display screen versus the size of a finger area to permit complete discrimination between selected or pointed areas.

For more information contact Megadata Corp., 35 Orville Dr., Bohemia, NY 11716; (516) 589-6800. *Circle No. 185.*

Visual Display Unit with Increased Line Capacity

An intelligent visual display unit (VDU) with increased line capacity has been developed by ATL Datatronics Pty. Limited of Australia. The Model 4800 has 48 rows of 80 characters (a total of 3840 characters) displayed on the 35 cm

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CIRCLE 21

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Also ask about REMOTE-80 Intelligent Terminal Software; SCREEN DESIGNER—interactively create and utilize video forms; and MLU—the complete Mailing List Utility. All run under any CP/M-based system (IMDOS, CDOS, etc.). BASIC interfaces implemented for most through CALL, and all have unique benefits.

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CIRCLE 22

(13.8 in.) vertically mounted CRT.

Unit features include a fully regulated switching power controller, microprocessor based logic and a monitor quality CRT to maximize character resolution. Selection of transmission speed, duplex or semi-duplex mode, parity and stop bit options are performed immediately when the unit is switched on, thus eliminating preset switches and wire links, all of which are potential causes of operational difficulty. Orange phosphor and an anti-glare etched face plate improve operator comfort.

Vertical mounting of the CRT reduces table space required for a terminal, and the ASCII keyboard connected by a 2 m (6.6 ft.) cable allows positioning for maximum operator convenience. The molded housing is simple to remove.

Production units are heat cycled for four hours following assembly and given 100 hours of automatically controlled circuit diagnostic testing.

For more information contact the Australian Government Trade Commission, 636 Fifth Avenue, New York, NY 10020. *Circle No. 181.*

DP-9 Produces 42" Wide Plots

Houston Instrument has introduced the DP-9 Drum Plotter. A plotting width of 42 inches, three programmable pens and many other special features are included in the $13,500 cost. Six high resolution step sizes are switch-selectable in either inch or metric increments, ranging from 0.01" to 0.00125" or 0.25 mm to 0.03125 mm. The DP-9 also features a joy stick control for direction and speed movement of the pen and chart. For more information contact Rod Schaffner, Houston Instrument, One Houston Square, Austin, TX 78753; (512) 837-2820. *Circle No. 180.*

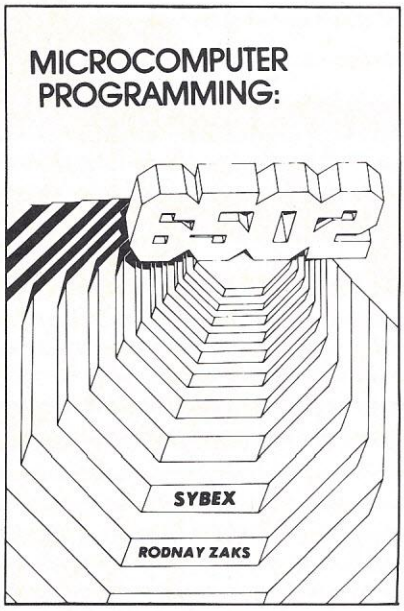
COMPLEMENTS

Manual IC Lead Straightener

Micro Electronic Systems, Inc., has announced a manual IC lead straightener, designated FIX-A-DIP. The unit includes adjustable spacers to accommodate IC widths of 0.3", 0.4", 0.5" and 0.6", 2 to 40 pin DIP's.

Customers can order the FIX-A-DIP factory adjusted to the width primarily required and then later adjust it to other widths. FIX-A-DIP is a dual set of specially cut racks, spring loaded in the open position. A badly bent IC lead needs only to be hand straightened slightly, then inserted into the rack. Using the other hand you simply strike the soft plastic handle

LEARN TO PROGRAM WITH THE 6502



● MICROCOMPUTER PROGRAMMING:6502
By Rodnay Zaks, ref C202 $9.95
This text will teach you how to program with the 6502, from ground zero if necessary: arithmetic, input-output, including polling and interrupts, addressing techniques. Completely self-contained, it can be used by the novice to learn programming or by anyone who wants to learn about basic techniques, using the 6502.
(The author has taught programming to more than 1000 persons).

● 6502 APPLICATIONS BOOK
(For SYM and KIM), ref D302 $12.95
A series of practical (hardware and software) applications for a 6502 board (SYM preferred or KIM) which can be used as experiments, or implemented at minimal cost. Examples are: morse generator, electronic piano, digital clock, home alarm system, traffic controller.

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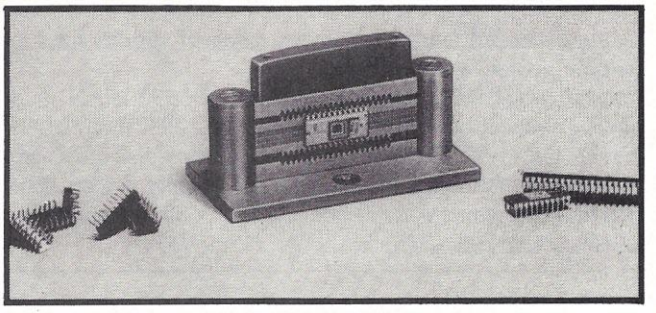


on the top of the unit and remove the IC with all leads straight.

FIX-A-DIP sells for $199.50 in single quantities and will be available from stock. For more information contact Micro Electronic Systems, Inc., 8 Kevin Dr., Danbury, CT 06810; (203) 746-2525. *Circle No. 144.*

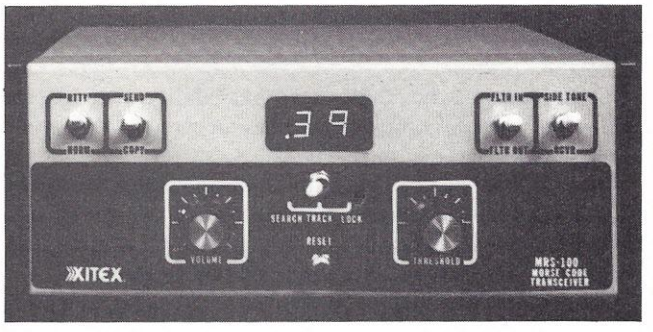
Morse Code Transceiver from Xitex

Xitex Corporation has introduced a Morse Code Transceiver designed around a preprogrammed single chip microcomputer for the generation and reception of Morse Code signals using a standard ASCII or Baudot terminal. Applications include military, amateur and commercial communication systems.

The microcomputer's on-chip 2048 byte ROM memory contains both the send and copy algorithms, plus a software UART with multiple ASCII and Baudot baud rates. All timing signals are generated internally from a single external 4 MHz crystal, reducing system costs and eliminating RFI generation or susceptibility.

The copy portion of the device provides automatic synchronization from 1 to 150 WPM while it is continuously computing and displaying the corresponding WPM value. The send mode features include precise control of the output Morse WPM rate in unit increments from 1 to 150 WPM, plus a 32 byte FIFO buffer which can be edited prior to transmission.

Another feature permits both send and copy operation in a



RTTY Emulate mode. This feature permits the transmission of a 60 character ASCII subset using standard Morse codes plus new codes defined for special symbols and control characters (such as line feed, space, carriage return, etc.).

The MRS-100 Morse Transceiver is offered in three basic configurations: partial kit including the Microcomputer and blank PC boards for $95; full kit including an enclosure, power supply and all other components necessary to config-

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CIRCLE 23

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24" x 30" schematic of the CPU board, plus oversized schematics of the Video Monitor and Tape Recorder, plus complete Parts layout—all accurately and painstakingly drawn to the minutest detail.

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CIRCLE 26

ure a complete system (less terminal) for $225; plus an assembled and tested unit for $295.

For more information contact Xitex Corp., 13628 Neutron, PO Box 402110, Dallas, TX 75240; (214) 386-3859. *Circle No. 139.*

Self-Adhesive Labels for Floppy Disks

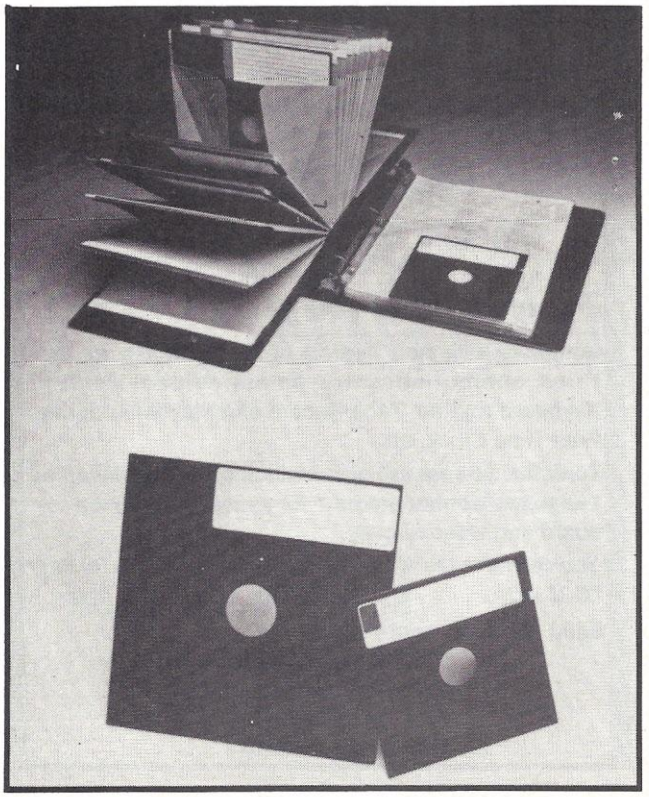
Two new self-adhesive labels for floppy and mini-floppy disks have been added to Avery Label's line of word processing labels.

Avery's white 5252 label, 5-1/4" x 1-3/4" with six pre-printed information lines, is used to record identification and instruction data for standard sized floppy disks. The label is placed at the top of the disk so that all data is visible, even when placed in its protective sleeve. If a blank label is affixed to the disk, a soft-tipped felt pen may be used to avoid damage to the magnetic disk surface.

However, since information lines on blank labels are printed with typewriter spacing, a typewriter may be used to prepare the identification labels prior to placing them on disks. The labels are made with removable adhesive, which leaves no residue as a new label replaces an old one.

The smaller 5253 label, 1-1/4" x 4-3/4", also white, has five pre-printed information lines. The 5253 is used for identification and instruction data on mini-floppy disks.

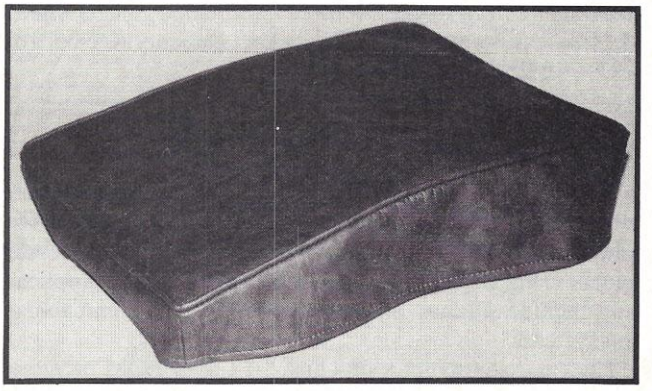
Both labels may be color coded for fast filing and rapid retrieval of floppy disks. The 5252 uses 1/2" x 1-3/4" Avery color coding labels in light blue, red glow, green glow, yellow glow and orange glow; the 5253 uses a smaller 1/2" x 3/4" Avery label in the same colors. These color coding labels allow disks with 5252 and 5253 white information labels to be quickly classified by visual inspection. If other coding is needed, additional Avery labels of various sizes in matching colors are available.



Retail price for a 50-sheet package of 5252 labels, two labels per sheet or a 34-sheet package of 5253, three labels per sheet is $1.95. These self-adhesive floppy disk labels are available at stationary stores and office supply dealers. For information contact Avery Label, 777 E. Foothill Boulevard, Azusa, CA 91702; (213) 393-9494. *Circle 137.*

Dust Covers

Digital Dynamics Inc. has announced the Computer Canopy line of dust covers for microcomputers and peripherals.



This line of covers includes models especially designed for the APPLE II and PET microcomputers and the H-9 terminal. Computer Canopy dust covers are made of heavy duty upholstery grade, multiple-ply vinyl with cloth backing. All top seams are reinforced with cording for rigidity and strength. The Computer Canopy is offered in deep textured walnut and textured tan. Suggested list price is $14.95 postpaid for the APPLE II Computer Canopy and $20.95 each for PET and H-9 models. For more information contact Digital Dynamics Inc., PO Box 27243, San Antonio, TX 78227. *Circle No. 141.*

Rove Industries Markets Personal Computer Supplies

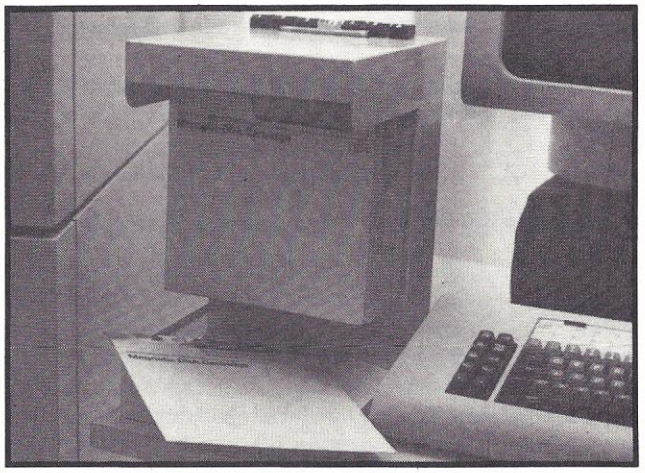
Rove Industries has announced availability of magnetic media and related computer supplies to personal computer users.

Their media includes diskettes, mini diskettes, standard 8-inch digital cassettes and magnetic cards. Mini diskettes come in soft, 10 and 16 sectoring. Single and dual-sided diskettes are carried in either single or double density.

For more information contact Rove Industries, 14279 Greenleaf St., P.O. Box 5209, Sherman Oaks, CA 91423; (213) 999-5830 or (800) 423-5106. *Circle No. 157.*

Diskette Retriever

RADR, the Random Access Diskette Retriever from American National Supply Corp., stores and retrieves 50 diskettes. The major feature of RADR is the ease of storing



the diskettes. Normally, a diskette must be returned to a fixed location in storage for future retrieval. With RADR, the diskettes are stored by hanging them in the front of the unit. For retrieval, the user depresses the selection buttons with the diskette's code and the desired diskette drops from the RADR unit ready for use.

For additional information contact ANSCO, PO Box 2259, Gardena, CA 90247; Toll Free 800-421-1270; in CA (213) 532-7780. *Circle No. 155.*

Repair Kit

Moody Tools, Inc., has introduced the Technician's Repair Kit into the company line of precision miniature tools for industry. The Technician's Repair Kit consists of six individual tool kits in one: screwdriver and awl kit, Phillips driver and Allen wrench kit, offset open-end wrench kit, drill kit, tap kit and socket wrench kit. Each individual kit contains five interchangeable tool ends and Moody handle. Each tool tip is constructed of hardened steel and all tools, except for taps and drills, are plated for durability.

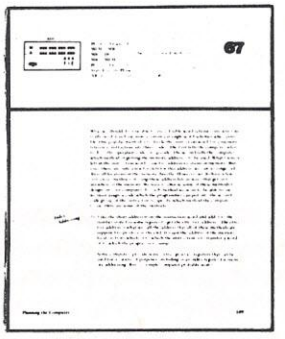
Individual kits are packaged in plastic containers with clear plastic domes and are stored in a compact, leatherette carrying case. The kit retails for $50.

For more information contact Moody Tools Inc., 42-46 Dudley St., Providence, RI 02905; (401) 421-5032. *Circle No. 148.*

See the computer. See the computer run. Read The Computer Book.

This is it – a workbook that actually *shows* you how a computer is organized, programmed, and run. How? Because the book *is* a computer! *The Computer Book.*

Here's how it works: the top third of each page graphically represents a memory location (illustrated at right) which includes memory and address registers to be filled in by you, the reader-as-programmer. The program steps are listed at the tops of the pages, and at each location you are given your next instruction(s) to carry out. You play the switch register and control circuits, a bookmark serves as the program counter, and your pencil is the line printer. Before you know it, you'll be "jumping to subroutine" and "clearing the link" with the best of them! More importantly, you'll understand exactly *why* you're performing each step as you run through the programs. Not even stepping a real computer through a program can provide a comparable learning experience – the reader is inside the computer!



The text of *The Computer Book* is presented in such a clear, down-to-earth style that it makes an ideal introductory reference for anyone, student and non-technician alike, who wishes to improve his/her understanding of the digital world. Contents include:

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- Peripherals
- What Goes On In There?
- The Instruction Set
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- Thumbs-On Experience
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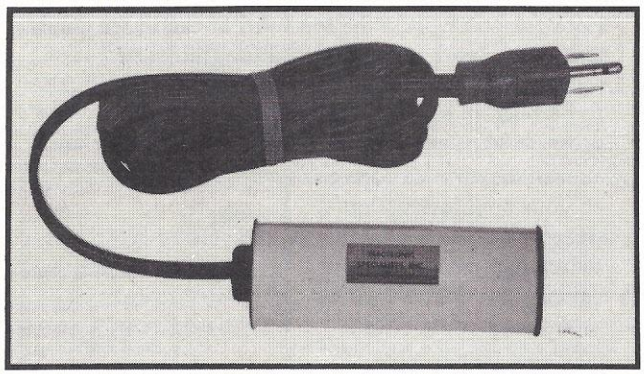
Glitch Killer

Glitches, false print-out and memory loss are often caused by lightning and machinery surges or AC power line hash. The AC Line Cord Suppressor/Filter introduced by Electronic Specialists brings glitch causing hash and surges under



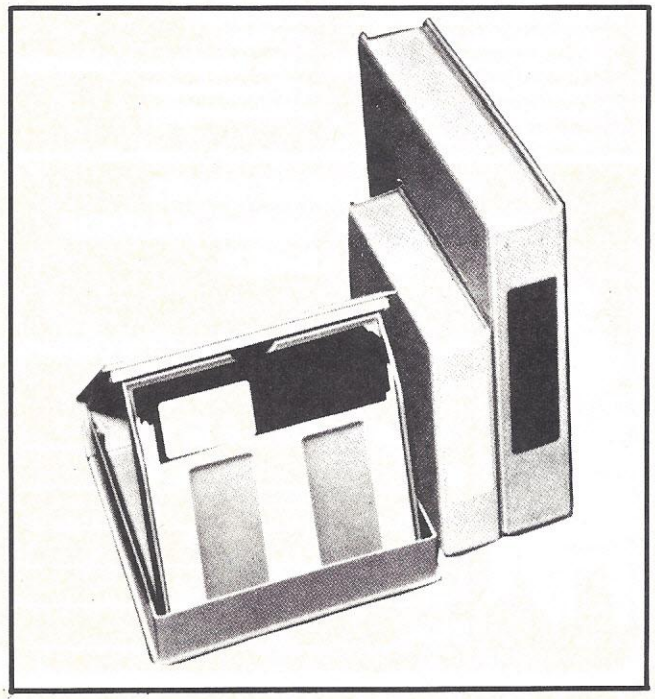
control, the company says. Capable of handling up to a 1000 watt load, the line cord suppressor/filter provides both line-to-line and line-to-ground protection. Model S/F-KW-3 is priced at $22.50. For more information contact Electronic Specialists, Inc., Box 122, Natick, MA 01760; (617) 655-1532. *Circle No. 146.*

Mindisk Library Case

The new MINIKAS-ETTE/10 is a mindisk-sized version of the popular KAS-ETTE/10 Diskette Library Case.

The cases safeguard recorded data by protecting against contaminants and offer temperature and humidity control for storage or shipping.

Durably constructed of extra strong polyprolene, the cases are finished in a beige leather-type texture. Additional features include flexible fan tabs providing firm vertical hold



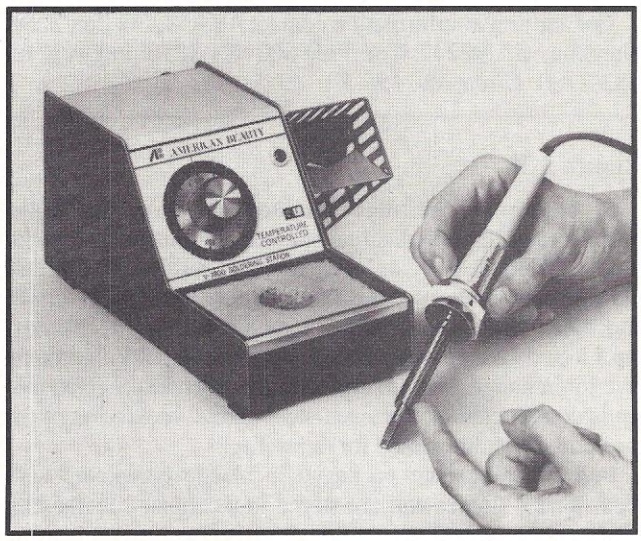
while allowing for easy media access and replacement, and pop-up easel design placing media within convenient view and reach of user.

Both cases are available from Misco Inc., 963 Holmdel Keyport Rd., Holmdel, NJ 07733; (201) 946-3500. *Circle No. 151.*

New Soldering Station Temperature Controlled

The American Beauty V-3800 soldering station maintains any tip temperature between 350- and 750-F (177-/399-C) within 5% of dialed setting, making the 40-watt station suitable for soldering critical electronic components and assemblies. A heat sensing collar just ahead of the heating element continuously monitors tip temperatures and signals a heavy-duty transformer to adjust input to the element. With the sensing unit built into the iron, expensive special tips with embedded sensors are eliminated. The V-3800 can use an almost unlimited variety of regular 3/16" x 2-1/4" (0.48 x 5.72 cm) plug-type tips.

Grounded, line-isolating circuitry protects delicate work from voltage leak damage. Built-in tip cleaner has a deep



reservoir from which a wick delivers water to the wiping sponge, keeping it moist for two to three days per filling. Safety cradle protects operator, automatically centers resting iron and maintains the best idling temperature.

For more information contact American Electrical Heater Co., 6110 Cass Ave., Detroit, MI 48202; (313) 875-2505. *Circle No. 143.*

Printout Storage System Available

Bound computer printout is given economical archival storage by the new DATA-PAK #648 manufactured by Bankers Box/Records Storage Systems.

Made of 275 lbs. test multi-ply corrugated fibreboard, DATA-PAK #648 houses 12" of bound printout protected by a dustproof lift-off lid. Tote handles front and back offer portability to the unit.

DATA-PAK #648 features a large labeling area for accur-

ate identification of contents and a retractable plastic handle giving easy removal from shelving. DATA-PAK #648 fits three across on 36" shelving. For more information contact Bankers Box/Records Storage Systems, 1789 Norwood Ave., Itasca, IL 60143; (312) 671-3119. *Circle No. 142.*

Cassette Deck Cleaner

Allsop Automatic, Inc.'s Allsop 3 cassette deck cleaner is designed for use in computer, automation, medical equipment and other instrumentation employing cassettes.

Allsop 3 simultaneously removes residue from the deck's head, capstan and pinch roller. The user simply inserts it into the instrument.

The unit helps prevent instruments from eating tapes and limits general tape slippage by wiping emulsion build-up off the pinch roller and capstan. Its wiper-arm motion scrubs the head and is non-abrasive through use of virgin wool felts.

Allsop 3 comes with a special formulated solution for application to its two felt pads prior to insertion into the cassette deck. Once the device is inserted, users merely depress the "play" button and Allsop 3 does the rest in 20 to 40 seconds. Suggested list for Allsop's cassette deck cleaner is $5.95. For more information contact Allsop Automatic, Inc., PO Box 23, Bellingham, WA 98225. (206) 734-9090. *Circle No. 150.*

HERE IS THE LATEST AND BEST IN 8080/Z80 DISK SOFTWARE

CP/M™ FDOS and Utilities		From $145
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Microsoft EDIT-80 Line Editor		$89
Xitan SUPER BASIC	(A3)	$99
Xitan DISK BASIC	(A3+)	$159
Xitan Z-TEL Text Editor	(A3, A3+)	$69
Xitan Text Output Processor	(A3, A3+)	N/A
Xitan Macro ASSEMBLER	A3, A3+)	$69
Xitan Z-BUG	(A3+)	$89
Xitan LINKER	(A3+)	$69
Xitan Package A3 (as keyed above)		$249
Xitan Package A3+		$409
Micro Focus CIS COBOL		$500
SOURCE Disk Based Disassembler		$70
ZASM Zilog™ Mnemonic Assembler		$45
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SMAL/80 Structured Macro Assembler Language		$75
CBASIC Compiler/Interpreter BASIC		$95
MAC Macro Assembler		$100
SID Symbolic Instruction Debugger		$85
TEX Text Formatter		$85
General Ledger		$995
Accounts Receivable		$750
NAD Name & Address Processor		$79
QSORT Disk File Sort/Merge Utility		$95

Most software available in a variety of diskette formats including: IBM 8" single and double density; North Star CP/M; Micropolis CP/M; and 5" soft sectored. All Lifeboat software requires CP/M to operate.

Watch for the December 1978 release of the above software on Processor Tech Helios II; Altair Disk; and iCOM Microdisk systems.

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CIRCLE 28

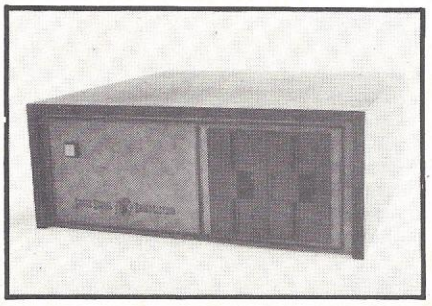
SYSTEMS

6800-Based Microcomputer from Smoke Signal Broadcasting

A new high performance dual-floppy microcomputer, featuring SS-50 bus compatibility and a new controller design, has been introduced by Smoke Signal Broadcasting.

The new Chieftain microcomputer is a versatile, general purpose system based on the powerful 6800 microprocessor with 32K of static RAM. Standard features also include two serial I/O ports, two mini-floppies and the compatible DOS-68 disk operating system.

Increased reliability is obtained through the use of gold connectors to eliminate continual re-seating of boards and a cooling fan to extend component life. The new microcomputer allows up to 60K of usable memory by adding two more slots. Disk storage can also be increased to four mini-floppies or four 8-inch floppies.



Price for the Chieftain microcomputer is $2595 retail. For more information contact Ed Martin, Smoke Signal Broadcasting, 6304 Yucca St., Hollywood, CA 90028; (213) 462-5652. *Circle No. 109.*

Mini-Computer Marketed by New England Firm

A new family of fast and inexpensive mini-computers has been announced by Northeast Services Corporation (NESCO) via exclusive distributors to the end user market. Called the ABLE Series, the computer is a 16 bit machine organized around 16 registers. Operation is asynchronous with an average excution time of 200 to 300 nsec.

The ABLE family includes three machines — the ABLE/20, 40 and 60. The line is based on a single central processor configured on two 4.5'' × 7'' circuit boards. The family uses MSI technology rather thatn LSI because of extremely high reliability and lower cost.

Software for the ABLE family includes the NESCO Assembly Language System and the Real-Time XPL Operating System. XPL is more powerful than BASIC and yet is easy to use and offers a high degree of portability, according to the company. The Real-Time XPL Operating System includes a full three pass compiler.

User applications include: data communications, real-time scientific, industrial control and business data processing.

A model ABLE/40 includes 32K bytes of memory, automatic program load in firmware, a real-time clock, an RS232 interface line (300 to 9600 Baud), 2 mini-floppy disks and controller (180 bytes), power supply and hand crafted wooden cabinet for $9160.

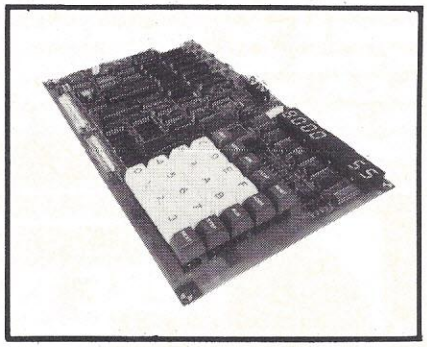
The ABLE family is designed around a bus structure called EZbuss, made up of three main buses. Data Transfers are made by means of a 16-bit Bi-direction Data Bus and an 8-bit Address/Instruction Bus serves to address all I/O devices and to carry instruction information to the register/ALU sections of the machine. Memory addressing is by means of an independent 16-bit Memory Address Bus.

Memory addressing is by word using the 16 bit memory address bus to enable direct addressing of 65,536 words. All memory addressing is indirect on a register: i.e. the register contents are used to point to the desired memory location. Any memory locations in the entire 65K memory space may be accessed by one instruction, eliminating the need for any paging or mapping complexity.

For more information contact Northeast Services, Inc., P.O. Box 373, Wallingford, CT 06492; (203) 265-1223. *Circle No. 106.*

Single Board Computer Uses 8080A as Processor

A single board computer designated the TK-80A using the industry standard 8080A was announced by NEC Microcomputers, Inc. Combining NEC Microcomputers' own uPD8080AF with 1K RAM and 1K of EEPROM (on board expandable to 4K × 8 RAM and 8K × 8 EPROM) the TK-80A is for computer education. Additional uses include process control, numerical control, environmental control and monitoring, distributed processing, perhipheral control, or any general computer application.



A full keyboard with 25 raised keys in conjunction with eight ½'' LED displays make the human interface easy to use. The TK-80A includes a 300 or 1200 baud cassette interface — the Kansas City type — and three 8-bit programmable I/O ports (24 lines). Extensive use of call subroutines makes most monitor services available for user programs. The unit's instruction set is complete. Both memory and I/O instructions are supported, easing the learning experience for students and programmers.

For more information contact NEC Microcomputers, 173 Worcester St., Wellesley, MA 02181; (617) 237-1910. *Circle No. 108.*

Ohio Scientific 540 Video Display

Ohio Scientific offers the video display interface from its Challenger IIP as a fully assembled accessory for any OSI system. The 540 video display has also been incorporated in the company's mainframe class personal com-

puter, the C2-8P and in two floppy disk based computer systems. The 540 video display features a 32 row by 64 column display of the standard 64 character ASCII font in 5 × 7 dot matrix form. Standard features include programmable formatting of the display for 32 × 32 or 32 × 64. The 32 × 32 mode is useful for video animation since it provides square character cells. The video board also features a keyboard port which can be used with a standard ASCII keyboard or OSI's new programmable keyboard. The 540 also optionally supports a graphics character generator which features lower case and about 170 special characters for plotting and gaming.

All systems using the 540 incorporate Ohio Scientific's new 542 programmed keyboard. This new keyboard appears to be a standard 53 key ASCII keyboard. In reality, it is a fully programmable keyboard system capable of upper and lower case and auto repeat on all characters. The keyboard also features up to five levels of shifting to allow many special single keystroke commands and direct single keystroke graphics. Ohio's 542 programmed keyboard has provisions for character editing and supports special formats for video games.

The model 540 video board is available as an add-on option for any existing OSI system as a CA-11 at $249. The graphics character generator option retails for $29. The 540 video display and 542 programmable keyboard combination are used in the company's Challenger IIP line and in its video I/O based floppy disk computer systems. For more information contact Ohio Scientific, 1333 South Chillicothe Rd., Aurora, OH 44202; (216) 562-3101. *Circle No. 103.*

Model 45 Microprocessor Based Timesharing System

Micro V Corporation has introduced the MicroStar Model 45 microprocessor based timeshare system. The MicroStar/45 is based upon a complete Single Board Computer reducing typical system maintenance costs to practical levels for even the smallest business.

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The MicroStar/45 Timeshare, Small Business System features the UPDATE Data Base Management System. UPDATE is capable of reducing or eliminating the expense of custom programming. Personnel with no computer experience can be trained in the effective use of UPDATE in 2 to 4 hours.

UPDATE assumes that everyone has need for special reports. The user or system supplier can easily define a dictionary of words. To generate a report the user enters the selection criteria and the words which identify the columns of data that he wants on the report. The dictionary then transfers these words into computer action. This capability represents an English language dialog between the information system and user.

STARDOS is a multi-user timesharing system. In addition to UPDATE it supports interactive BASIC, sequential, relative and indexed sequential files, powerful string handling and multi-user file protection. Application programs immediately available with the system include order entry, invoicing, accounts receivable and general ledger.

The MicroStar/45 is contained in a table top console 8'' high by 17½'' wide by 24'' deep. It contains two doublesided 8'' floppy disk drives, power supply and the single board computer with 65KB RAM, microprocessor, DMA, real time clock, programmable interrupt controller, three RS 232 interfaces with programmable sync and async baud rates and floppy disk controller.

For more information contact Micro V Corporation, 17777 S.E. Main St., Irvine, CA 92714; (714) 957-1517. *Circle No. 105.*

MicroStar/5 Single Board Computer

The MicroStar/5 Single Board Computer is a complete microprocessor based computing system available on a single 9½ × 13½'' board. It supports the CP/M disc operating system including BASIC, FORTRAN IV and COBOL.

The MicroStar/5 integrates a microprocessor (INTEL 8085), Floppy Disc Controller (INTEL 8271), Random Access, Programmable Interrupt Controller and 2 RS232 peripheral/terminal interfaces. A 32K RAM version of the MicroStar/5 is priced at $1270 in OEM quantities.

The system will interface a variety of IBM compatible floppy disk drives including Shugart SA 800 and SA 850, the Calcomp 142M and 143M, the Per-Sci 277 and the Shugart mini floppy SA 400 and SA 450. Printers available with the system include Teletype, Centronics, and Diablo.

System software includes a macro assembler, interactive debugger, interactive editor and text processor. A bootstrap loader is an integral part of the system stored in ROM. It runs diagnostics and provides automatic loading from disc.

A CP/M aplication software development system including 32K RAM and dual floppy disc drive (512KB) is $3995 with RS232 interfaces for video display terminal and line printer. For more information contact Micro I, 17777 S.E. Main St., Irvine, CA 92714; (714) 957-1517. *Circle No. 104.*

98255 Desktop Computer from Hewlett-Packard

A new version of the 9825A desktop computer was announced by Hewlett-Packard. The new 9825S features 24K bytes of memory, three times the standard memory of the 9825A, plus some features which have been optional in the A model.

The 9825S includes the Strings/Advanced Programming ROM and the 9872 Plotter/General/Extended I/O ROM. The system is priced at $7700.

Both versions of the 9825 desktop computer can be used in engineering, mathematics and statistics applications, as well as instrument-control functions. Interfacing to instruments and peripherals is accomplished through 16-bit parallel, bit serial, BCD or the HP Interface Bus. For more information contact Inquiries Manager, Hewlett-Packard Company, 1507 Page Mill Road, Palo Alto, CA 94304; (415) 856-4105. *Circle No. 100.*

Pro-Log Buffered PROM Programmer

A new PROM programmer with a built-in data buffer allowing transfer of data from one PROM type to another has been introduced by Pro-Log Corporation.

The new M900B Buffered Control Unit has a 2K × 8 CMOS read/write buffer memory that allows AC power to the unit to be removed for up to one minute with no loss of data in the memory. The user can thus remove one PROM personality module and replace it with another, easily transferring data between PROM types and sizes. The buffer memory can also be switched out for direct PROM-to-PROM copying.

User advantages include the ability to load data into the buffer and verify it before programming begins, and increased speed of communication with the unit supplying the programming data due to the M900B's uninterrupted serial bit stream operation.

The M900B data location shift capability allows data not only to be moved from buffer to PROM, but also permits blocks of addresses stored in the buffer to be moved to any location within the PROM being programmed.

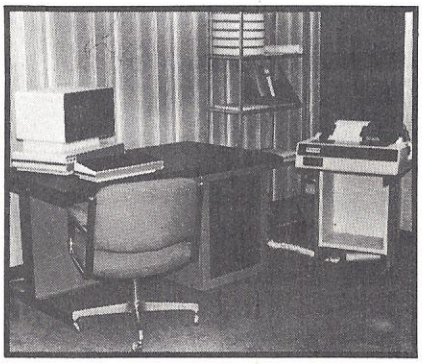
The M900B Buffered Control Unit, housed in a carrying case, is available for $2100. For more information contact Pro-Log, 2411 Garden Road, Monterey, CA 93940; (408) 372-4593. *Circle No. 101.*

Minicomputer System for Contractors

Complete Computer Systems has announced Builder I, a turnkey minicomputer system for both residential and commercial builders. The system is designed for use by personnel with no computer background or experience.

Builder I is aimed at reducing risk and increasing profitability and control for both large and small construction firms. It provides up to the minute information on labor and materials from suppliers and subcontractors. According to the company, Builder I helps users avoid cost overruns and schedule slippages.

The system automates job cost, payroll, accounts payable and general ledger. In addition, Builder I includes Complete's CREATE capability, permitting management to create their own special reports following step-by-step instructions on the screen of any of the system's CRT terminals.



Builder I simplifies data collection and entry procedures associated with labor and cost tracking. All data is validated on entry through instructional displays on the CRT screen. The system prints paychecks and stores information for government, insurance and union reporting. Weekly, monthly, quarterly and annual reports are generated for management and employee W-2 and quarterly 941 forms are prepared.

Labor charges are also applied to each job, lot and model for use in job status reporting. Job reports summarize labor, material and overhead charges and highlight variations from budget. Reports may be on individual activities, subcontractors and jobs for a specified time period or on a to-date basis.

Control of material extends to tracking costs by item, vendor and job. Accounts payable information may be retrieved by vendor, vendor invoice number, item or voucher number. The system prints checks and prepares periodic accounts payable reports. A selection of other reports associated with

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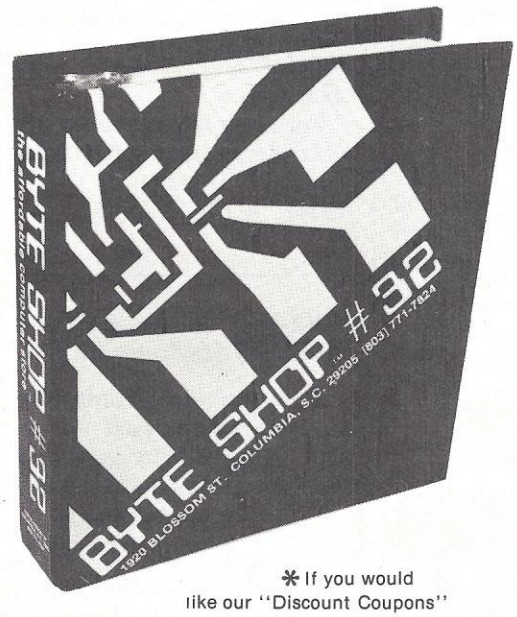

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general ledger accounting is also included. Builder I with a 64K minicomputer, ten megabyte disk, 120 cps printer and one 80 × 24 CRT starts at $42,795.

For additional information contact Complete Computer Systems, 159 Gibralter Rd., Horsham, PA 19044; (215) 441-4200. *Circle No. 110.*

Microcomputer Programming Training Aid for Microprocessor Users

A low-cost microcomputer system about the size of a desk-top calculator, designed to benefit anyone desiring an in-depth knowledge of how a microprocessor functions, has been developed by Signetics.

Known as the Instructor 50, the training aid for microprocessor users is completely self-contained, requiring no additional power supply, teletype keyboard, display terminal or other equipment.

The aid was designed by Signetics to enable the neophyte microprocessor user to make an easy transition into the application of the Signetics 2650 and other microprocessors at a reasonably low cost, according to the company.

In actual operation, the Instructor 50 will enter the monitor as soon as power is applied, since there is no on/off switch. After the monitor responds by displaying "HELLO", the user may enter his program.

The monitor allows the user to write any standard 2650 program, starting the program anywhere in memory or by issuing a RESET command. The user has available one parallel I/O port, providing 8 switch inputs and 8 individual LEDs as a latched output port. Also available is a FLAG/SENSE serial I/O. A single LED is attached to the processor FLAG output and a push-button SENSE key allows the user to test the processor sense input.

Additionally, the user may interrupt operation by issuing the interrupt provided on the function keyboard.

Program debugging is accomplished on the Instructor 50 by placing a breakpoint in the user program or by single-stepping the user program. Execution is then continued when the user issues a new breakpoint or single step.

The Instructor 50 is priced at $350 and is available from Signetics or its authorized distributors.

For further information contact Sig-

netics, 811 East Arques Ave., Sunnyvale, CA 94086; (408) 739-7700. *Circle No. 107.*

SOFTWARE

ASI Business Software Available on IMSAI Systems with IMDOS

Arkansas Systems has announced its business software for microcomputers is also available on IMSAI systems with the IMDOS operating system.

The software will be available through dealers on most microprocessors with CP/M-like operating systems, according to the company.

Payroll and General Ledger sell for $775 each, Accounts Receivable and Accounts Payable for $495 each or all four for $2250. Descriptive literature is available from ASI. For more information contact Arkansas Systems, Inc., 8901 Kanis Road, Suite 206, Little Rock, AR 72205; (501) 227-8471. *Circle No. 111.*

6K Assembler/Text Editor for APPLE II Available from Aresco

Aresco has announced their 6K machine language program for the APPLE II personal computer, an assembler/editor with full capabilities for source file editing and a comprehensive set of assembler directives.

The Assembler/Text Editor lets you enter and edit assembly language programs using standard 6502 mnemonics. Source text, object code and symbol table may be located anywhere in your APPLE II memory space.

The editor is an adaptation of Aresco's KIM-1 ASM/TED, which has been available for over two years. The program comes on cassette tape, with full user documentation, for $29.95 from Aresco, P.O. Box 43, Audubon, PA 19407. *Circle No. 112.*

Inventory Management System from Wyle Laboratories

Wyle Laboratories has announced W.O.R.D.S. (Wyle On-line, Real-Time, Distribution System). W.O.R.D.S. is an inventory management system which combines the multiple aspects of the distribution into a single on-line/real-time process, the company said.

The system is designed for use in sales environments and provides features for file maintenance, inside sales, order entry, inventory control and accounts receivable. It utilizes real-time processing to link together multiple warehouse locations and provide immediate access to inventory, sales orders, purchase orders and accounting information. Present users of IBM 360/370 equipment will find the W.O.R.D.S. package immediately compatible.

For more information contact Wyle Data Services, 15302 Bolsa Chica Avenue, Huntington Beach, CA 92647; (213) 598-9555. *Circle No. 113.*

Data-Base Management System for Small-Business Applications

Ohio Scientific has introduced a low-cost programming aid for small-business microcomputer applications. This software called OS-DMS, brings the use of microcomputers down to the level of non-programmers, the company said. It allows untrained computer users to store and recall information from any one of Ohio Scientific's floppy and hard-disk microcomputer systems. Each program in the OS-DMS library is aimed at a specific small business ap-

plication, such as real estate, automotive sales, mailing lists, inventory, accounts receivable/accounts payable, inventory/invoice, ledger, personnel files, retail sales or medical files. Because the microcomputer uses terms familiar to each specific application, the user doesn't have to learn exotic programming languages. Manufacturer's suggested retail price is $300.

In addition to making computers useable for untrained small-business users, Ohio Scientific's OS-DMS data-base management system allows knowledgable computer operators to fully utilize the computer's resources and perform tasks routinely which usually require programming on other systems.

OS-DMS can create a personnel file for a company in conjunction with a specific application such as the OS-DMS payroll program. Another program called Query can quickly obtain an employee's phone number. An OS-DMS mailing list program can automatically generate mailing labels for all employees. One of OS-DMS's report-writer programs can be used to generate management reports such as employee lists, wage lists or seniority reports. All these tasks can be accomplished by a computer user without any programming knowledge. The person makes a few menu selections and answers questions to obtain these results.

For more information contact Ohio Scientific, Inc., 1333 S. Chillicothe Road, Aurora, OH 44202; (216) 562-3101. *Circle No. 126.*

Multi-User BASIC with COBOL File

Panatec Inc. has announced PANA/BASIC, a multi-user operating system, extended BASIC language processor and comprehensive file management system for use on a variety of microprocessor systems. PANA/BASIC software features include: time shared multi-terminal operating system; file capabilities equivalent to ANSI COBOL; powerful string handling capabilities; interactive data entry and control; quick response time in multi-terminal environment; sequential, relative, and indexed-sequential files; COBOL style format edit control and string match; variable length strings and string arrays; decimal accuracy up to 15 digits; binary integer capability; system commands and procedures; expanded relational and logical capabilities; queued input/output for efficiency; high performance indexed-sequential files; multi-user file protection; external subroutine capability; background processor; and inter-task communications.

The string handling capabilities in PANA/BASIC make this language suited to text editing, word processing, and data formatting. PANA/BASIC includes both substring reference and string arrays.

A concise and powerful string notation allows insertion, deletion and replacement within strings and substrings

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by algebraic notation instead of functions. Substring notation may be used on both the left and right side of the equal sign.

Edit facilities include decimal point alignment, zero suppression, comma insertion, asterisk check protect, floating dollar, credit or debit, and character insertion. Tab functions and cursor control facilitate printer and screen formatting. Input data can be checked for validity using the string edit match operator. For more information contact Mike Artell at PANATEC, 1527 Orangewood Avenue, Orange, CA 92668. *Circle No. 115.*

Individual Tax Return Program

The QuickTax system from John Abbott Productions will calculate and print out all figures and taxes for the following government tax forms and schedules: Form 1040A; Form 1040 — which includes: Schedule A, Schedule TC, Schedule G, Schedule R, Form 4625, Form 3468, and Form 4726. Programs are also available for Schedules B, C, SE and Form 2210.

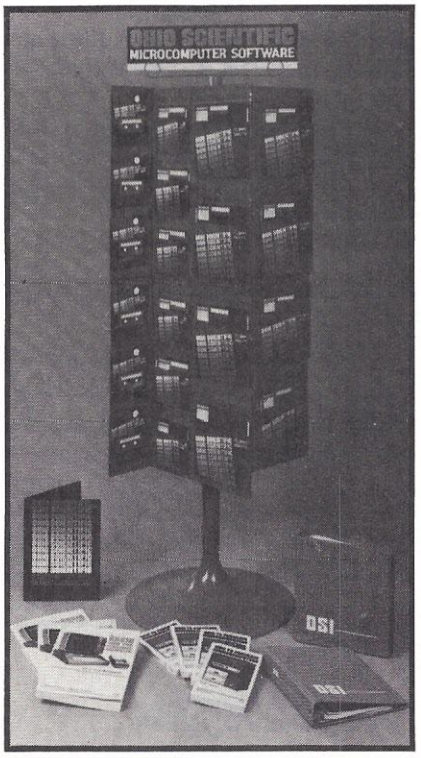
The QuickTaxprograms are written in Micropolis Basic and require a computer with a minimum of 48K memory, a Micropolis Mod II disk drive and printer. Programs are supplied on diskettes, and include documentation and instruction manual.

The QuickTax programs can be used interactively (they will branch to the required forms if conditions are met) or individually. The system will cost between $250 and $500, depending upon the number of schedules ordered. For more information contact QuickTax, A division of J.A. Abbott, Inc., 60 Mason Street, Staten Island, NY 10304. *Circle 119.*

Retail Promotional Efforts from Ohio Scientific

'Ohio Scientific has announced an expanded software library.

Their library is available from Ohio Scientific dealers in packaged cassette, floppy diskette and mini-floppy diskette form. The cassette programs include subjects like PERSONAL: Annuity, Interest on Loans, Loan Finance, Checking Account, Calorie Counter; BUSINESS: Straight and Constant Depreciation, Bond Evaluation, Ratio Analysis, Break Even Analysis; EDUCATION: Basic Math, Mathink, Powers, Homonyms; GAMES: Tiger Tank, Lunar Lander, Torpedo, Star



Trek, Breakout. For more information contact Ohio Scientific, Inc., 1333 S. Chillicothe Road, Aurora, OH 44202 (216) 562-3101. *Circle No. 124.*

Integrated Business Package

The Integrated Business Package from Interactive Computers is a set of bookkeeping functions offering immediate updating, reporting and inquiry for the following business accounts: general ledger, accounts receivable, accounts payable, inventory and payroll.

A single entry automatically updates all applicable accounts. Printed output includes: aged accounts receivable, payables, inventory status, payroll, mailing lists (customer, vendor, employee), balance sheets (single and comparative), income statements (single and comparative), general ledger trial balance, budget report, general ledger chart of accounts, invoices and purchase orders.

Eight subsidiary journals provide a detailed audit trail to the general ledger. A complete user's manual (170 pages) is supplied with each copy of the software.

For more information contact Interactive Computers, 7646-1/2 Dashwood, Houston, TX 77036. *Circle 118.*

Software Line for 8K PET Computer

VIP Enterprises has made available on cassette tape ten programs for the 8K PET computer. Some of the programs include: Hangman II — you can guess the computer's word, or the computer can guess your word, with running totals displayed; Pro Tic-Tac-Toe — a novel approach to this old game; Psychological test — uses actual interactive questions to determine your ability to make and keep friends; Mystery quiz; plus six other programs using PET's graphics capabilities.Tape #1 with ten programs costs $5 ppd.

For more information contact VIP Enterprises, P.O. Box 17011, Salt Lake City, UT 84117. *Circle No. 200.*

CIS COBOL Interface Kit

Micro Focus has introduced an interface kit allowing their CIS COBOL compiler to be adapted to run on different 8080 and Z80 microcomputer hardware configurations. The interface kit comprises the CIS COBOL compiler and the Run-time system in object code form. It comes complete with extensive documentation including an interface manual and a system test library of 25 programs. The interface kit improves the portability of CIS COBOL, making an attractive proposition for the OEM.

CIS COBOL provides a subset of the established American National Standards Institute COBOL and will run as a totally resident system on any computer capable of byte addressing. In the case of Z80 or 8080 systems, all that need be done is to write two simple program modules — one to interface with the user operating system and the other to drive the CRT. The actual linking is performed by patching a series of jump instructions in a vector block within CIS COBOL.

For further information contact Paul

O'Grady or Brian Reynolds, Micro Focus Limited, 18 Vernon Yard, Portobello Rd., London W11 2DX, England. *Circle No. 122.*

Software from the Computer Place

PASCAL, a language whose structure permits users to deal with a program at many levels of abstraction one at a time, is now available from The Computer Place for Alpha Micro Computers.

PASCAL is free to all new and existing Alpha Micro users.

PASCAL features allow definition of new data types to express data meaningfully; provide structures with which data can be expressed clearly and naturally; and encourage formation of logical, structural programming.

The Computer Place also introduced Alpha Micro Extended Software Development tools that let you generate, manipulate and maintain large sets of application programs.

AMEXPD gives the BASIC programmer the capability of organizing complex systems via !INCLude statements. An !INCLude statement in a source file processed by AMEXPD permits copying an arbitrary number of !INCLude files into the source. !INCLudes may be nested up to 5 levels. The files are renumbered to avoid line number conflicts.

AMEXRF works with AMEXPD to provide the programmer with a complete cross-reference of any ALPHA BASIC program. The cross reference includes all variables (where they are declared, set and referenced), all labels and how they are referenced. Further, all cross reference items from an !INCLude file are flagged with the file name.

AMESUB permits bulk substitution of strings. It is driven either from a substitution file or directly from the console. AMEFND locates and displays all occurrences of a given string. AMERES resequences a BASIC program. AMELST prepares and passes to the spooler a formatted listing of a module with or without !INCLude expansion. Price is $175 for object code only or $375 with source code.

For more information contact Bruce Anderson, The Computer Place, 186 Queen Street West, Toronto, Canada M5V 1Z1; (416) 598-0262. *Circle No. 117.*

Compatible Disk Operating System

A new disk operating system for the Z-80 and Micropolis disk drives, featuring compatibility with software written for the North Star DOS, has been introduced by Vector Graphic Inc.

The system, called MZOS, supports the Vector MZ computer system or a similar configuration and incorporates such features as implied execution, which permits a file to be executed by typing the name, instead of the GO

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command. MZOS allows the directory to be listed in two different formats, either in a two-column format for viewing 32 entries at once or in a six-column fast format. In addition, the drive is recalibrated each time the directory is listed so that any drive may be set to the default, eliminating the need to reload.

Other features include a comprehensive set of error messages and a special method of writing the data on the disk. This method associates a unique identification with each sector, eliminating the possibility of unknown seek errors. Files may be protected against deletion, too. Added commands allow verification of sectors of files and renaming of files.

The Micropolis drives hold 315K bytes apiece, providing over 3.5 times the storage of a conventional Shugart drive and seven times the storage in a dual system. In addition, four drives may be supported rather than just three.

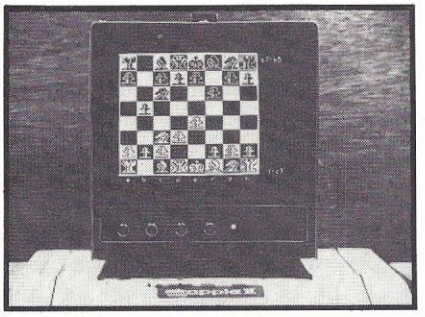
Price for the MZOS is $60. The product can be purchased from authorized Vector Graphic dealers or factory direct. For more information, contact Yvonne Beck at Vector Graphics Inc., 31364 Via Colinas, Westlake Village, CA 91361; (213) 991-2302. *Circle No. 127.*

PET, TRS-80, APPLE Additions

Personal Software has announced game and assembler additions for PET, TRS-80 and APPLE computers.

The 6502 Assembler in BASIC lets you write programs in assembly language for the 6502 microprocessor, and have them translated to machine language for direct execution on the PET. The assembler accepts all standard 6502 instruction mnemonics, pseudo-ops and addressing modes and evaluates binary, octal, hex, decimal and character constants, symbols and expressions. Source programs can be read from cassette, and object programs can be assembled anywhere in memory. The package includes both one and two pass versions of the assembler, a text editor and disassembler, and a 30 page manual with PET machine language programming hints, for $24.95.

Microchess is the culmination of two years of chessplaying program development by Peter Jennings, author of the 1K byte chess program for the KIM-1. Microchess 2.0 for 8K PETs and 16K APPLEs, in 6502 machine language, offers eight levels of play to suit everyone from the beginner learning chess to the serious player. It examines positions as many as 6 moves ahead, and includes a chess clock for tournament play. Microchess 1.5 for 4K TRS-80s, in Z-



80 machine language, offers three levels of play. Both Level I and Level II versions are included and can be loaded on any TRS-80 without T-BUG. Microchess checks every move for legality and displays the current position on a graphic chessboard. You can play white or black, set up and play from special board positions, or even watch the computer play against itself. Microchess is available at an introductory price of $19.95.

Bridge Challenger, for 8K PETs, 16K Level II TRS-80s, and 16K APPLEs, lets you and the dummy play four person Contract Bridge against the computer. The program will deal hands at random or according to your criterion for high card points. You can save hands on cassette and reload them for later play, review tricks, rotate hands East-West, shuffle only the defense hands, or replay hands when the cards are known. No longer do you need four people to play. Bridge Challenger is priced at $14.95.

For more information on any of these products contact Personal Software, P.O. Box 136, Cambridge, MA 02138; (617) 783-0694. *Circle No. 120.*

8080 Simulator for the 6502

Dann McCreary has announced a 8080 Simulator for the 6502. Available now in a KIM-1 version, the 8080 Simulator executes the entire 8080 instruction set. All internal 8080 registers are maintained ready for convenient examination or modification of their contents. In its minimum configuration on the KIM-1, the 8080 Simulator supports register single-step, program counter single-step and run modes. It also offers an input and an output port, breakpoint operation and rejection of illegal op-codes.

The 8080 Simulator runs in less than 1K of memory, leaving up to 224 bytes of 8080 programming space on an unexpanded KIM-1. The Simulator may be relocated in ROM and can be adapted to other 6502-based systems.

Well suited to all but time-sensitive applications, the 8080 Simulator may be used to assist in the design and testing of 8080 software, used as a training aid or used for running most 8080 application software.

A complete 8080 Simulator package is now available for the KIM-1. It consists of a KIM-1 format cassette tape, a user manual and a complete, commented assembly level source/object listing. The package is priced at $18 plus $1.50 for postage and handling.

For more information contact Dann McCreary, 4758 Mansfield St., #2T, San Diego, CA 92116. *Circle No. 121.*

Real Time Operating System from PCC

A Real Time Operating System (RTOS) for iCOM FD3812 double density flexible disk drives has been announced by Pertec Computer Corp. RTOS is suitable for end users requiring multiple job streams from their microsystems, the company said.

Functions of the system include multi-tasking control and management, intertask communication and synchronization, input/output management and interrupt processing, real-time clock control, resource management and protection and file management capabilities.

Minimum memory requirement for control functions, in the compact RTOS basic kernel or nucleus, according to PCC, is 2K of code. A typical end-user system that includes a console driver, multi-unit disk driver, file manager and reasonable buffer storage requires less than 8K of storage.

For further information, contact

Steve Elsner, COM Marketing Manager, Pertec Computer Corporation, Microsystems Division, 20630 Nordhoff Street, Chatsworth, CA 91331, (213) 998-1800. *Circle 128.*

Software from NCR

NCR Corporation has announced two new software systems.

The first facilitates the development of on-line communications networks for organizations which must handle a large volume of transactions. The TRAN-PRO (Transaction-Processing) System supports over 200 on-line terminals and can process more than 10,000 transactions per hour, thus lending itself toward use in large networking environments.

Designed to operate with either NCR 8000 Criterion of NCR Century Series computers, TRAN-PRO can function in a multiprogramming environment, permitting the user to operate present systems while concurrently implementing a more advanced on-line transaction-processing system.

TRAN-PRO works with the NCR TOTAL data base management system, allowing the user to organize data into an integrated, comprehensive data base, further facilitating the implementation of on-line systems.

Application programs are also independent of the terminals used. A terminal can be added or changed and the application program does not have to be altered to accommodate the change. Application programs may be written in industry standard COBOL 74. The general version of TRAN-PRO is priced at $22,000 with an annual maintenance fee of $960. It rents for $555 monthly including maintenance.

NCR also announced a new software package for wholesalers of products which require control records by serial number, such as major appliances, auto-parts or firearms.

The Wholesale Distribution System features interactive data processing, with all information entered via a visual display terminal linked to an NCR I-8320 computer. The operator is led through each data-entry step by instructions on the display screen. Data is acted upon immediately and all files are instantly updated.

The display terminal can also be used to check the inventory level of items or the status of customer orders or accounts. With the system's high degree of interactivity and ability to update files as transactions occur, there is no need for daily, weekly or monthly update runs which are common in most systems in this price range, according to the company.

Potential users of the new system include auto-parts wholesalers, sporting-goods wholesalers, appliance wholesalers or other firms which require close control of serially numbered merchandise.

The system also includes applications for order processing, accounts

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receivable, inventory control and sales analysis. All applications are written in COBOL 74 and operate in a multiprogramming environment so that several applications can be executed concurrently.

The system uses an I-8230 computer with 64K bytes of memory, 9.8 million bytes of disk capacity, a line printer and a visual display terminal. The complete software application can be purchased for $6,250 or rented for $150 a month. The software can be used in conjunction with NCR's interactive general-accounting applications. These include payroll, general ledger and accounts payable.

For more information contact NCR Corp., Dayton,OH 45479; (513) 449-2150. *Circle No. 114.*

MTX Display Software Packages

Two new software packages are now available to support the two high resolution, S100 bus compatible alphanumerics and graphics video boards from Matrox. The first of these boards is the ALT-2480, giving a 24 line x 80 column alphanumeric display. The second is the ALT-256, a self-contained 256 x 256 high resolution graphics board. Both cards can be used either singly or in combination to configure a wide variety of intelligent display systems. Examples include an intelligent alphanumeric terminal and a color or grey scale graphics imaging systems with superimposed alphanumerics. The software packages can support a wide variety of applications.

The MTX-GRAPH software package is designed for use with the ALT-256 graphics display. The package is configured as a series of callable sub-routines and occupies a 1K block of memory. Some features included in MTX-GRAPH are point plot and line vector graphics, variable size alphanumeric character generation, animation synchronization and an option for color graphics.

For more information contact Matrox Electronic Systems, P.O. Box 56, Ahuntsic Stn., Montreal, Quebec, Canada H3L 3N5. *Circle No. 123.*

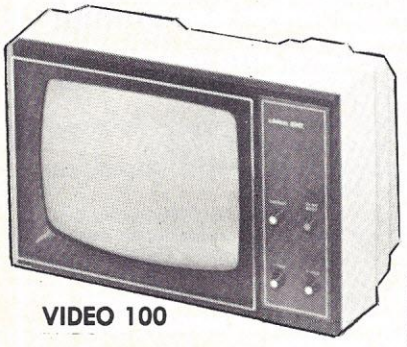
PC BOARDS

Video Display Board

Vector Graphic Inc. announces its video display board. Requiring only +8 VDC at 1.2 Amps, the flashwriter generates a video display of 1024 charaters (16 lines × 64 characters) and uses a 7 × 9 dot matrix to produce high quality, high resolution display images. The board also has an eight bit parallel port with latched strobe that may be used as a keyboard port.

In addition to alphanumeric displays, the Flashwriter can generate character-by-character, reversed video, reduced intensity, block and line graphics.

The Flashwriter is fully compatible



VIDEO 100

The Video 100 is designed to meet your monitor needs for both personal and business use. It is compatible with a wide range of computer systems, and with a band width of 12 MHz it is capable of displaying up to 80 characters per line on the 12" B/W CRT. The solid state circuitry assures a stable, & sharp display. The front panel controls include power, contrast, horizontal and vertical holds. Adjustments for height, vertical linearity, and width control are located on a rear panel. All the above features for only **$139.**

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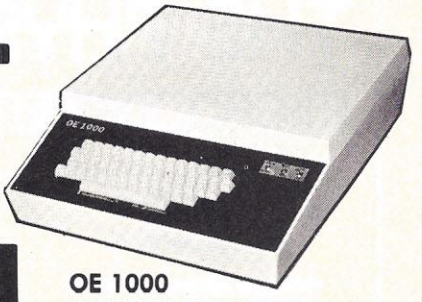

OE 1000
VIDEO TERMINAL

The OE 1000 Video Terminal provides you with a low cost means to communicate with your computer. The OE 1000 will display 16 lines of 64 characters on a monitor or modified TV. The terminal will generate and display the full 96 ASCII character set (upper and lower case) plus 32 special characters (Greek letters and math symbols). The terminal will also erase to end of line, erase to end of screen, scroll, and it has full X-Y cursor movement. Interfacing to your computer requires a full duplex, serial, RS 232 or 20 mA loop I/O port at the rate of 110 or 300 baud. The OE 1000 sells for **$350** assembled or **$275.** in kit form.

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with most S-100 bus microcomputers. Its video output conforms to RS-170 requirements and is available as composite video or separate video and sync.

Available completely assembled and tested, or in kit form from Vector Graphic dealers, the Flashwriter costs $195 kit, $235 assembled.

For more information contact Yvonne Beck, Vector Graphic Inc., 790 Hampshire Rd., Westlake Village, CA 91361; (805) 497-6853. *Circle No. 169.*

Economical Graphic/Text Video Interface for S-100 Microcomputer

MiniTerm Associates, Inc., has developed Merlin, a combination test and graphic video display board combining functions of test display, graphic display (320H by 200V resolution), keyboard input port, and 4K bytes of onboard control ROM.

The Merlin video interface, plus keyboard and video monitor, is an intelligent console I/O device for small systems (a "total" system requires only mainframe, CPU and memory). Merlin's 20-line text display with 40 cpl is suitable for text editing, BASIC and assembly programs and large screen classroom use. Both upper and lower case characters can be displayed. Merlin is also a medium resolution graphic display for graphic development and end-user systems. The standard resolution is 160H by 100V, true bit mapped graphics. This can be increased to 320H by 200V (64,000 bits per screen) with the Super Dense option.

The 4K control ROM firmware provides a keyboard driver with special "Edit key" decoding, display output with auto-and "wrap-around" scrolling, fourteen monitor functions, twenty-five cursor/edit functions, plus graphic subroutines and a keyboard graphic drawing mode. The firmware can be tailored to your individual system with four user definable monitor keys, seven edit keys, and selectable I/O drivers.

Merlin's sophisticated DMA controller displays information from any part of the computer memory. The display address as well as the display mode (test, graphic, or "split screen")

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☐ Gold plated **86-pin connectors** (one required for each plug-in board). **$5.70** postpaid.

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are software programmable. The control firmware allows the user to define two separate "display areas" and modes and to instantly change from one to the other with a single keystroke. The default test mode is a memory saving "free format" mode that displays lines literally without the need for space fill characters at the end of each line. The editor is an efficient "cursor" editor and includes commands for cursor movement, paging (forward and reverse), insert, replace, and delete character, line or block.

The Merlin video interface provides the main console I/O in a small system, or can be the heart of a sophisticated graphic development system. Merlin is also economical and versatile enough for OEM graphic applications. In any application needing real time plotting, complex equation plotting, fine line drawing or pattern placement and/or movement, Merlin can fill the job.

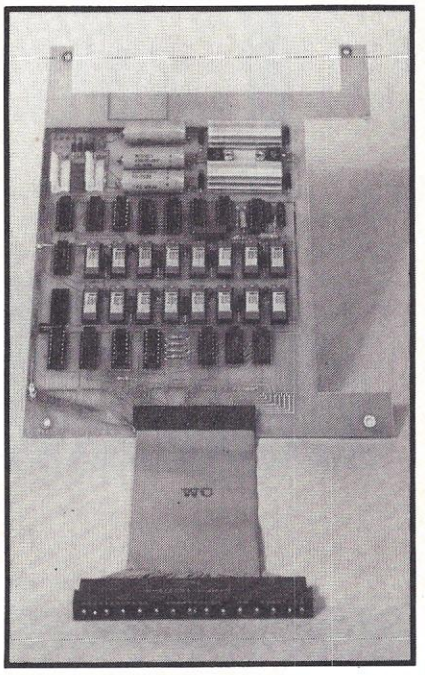
Assembled and tested, the Merlin video interface with 4K control firmware and super dense graphic option is priced under $500. Merlin is also available in kit form without ROM software for less than $300. For more information, contact Dave King, Miniterm Assoc., Inc., Dundee Park, Andover, MA 01810; (617) 470-0525. *Circle No. 161.*

Memory Board

Computer Mart Systems offers the PME-1 Memory Board in three configurations, designed to add 16, 24 or 32 kilobytes of memory to the Commodore PET computer. The PME-1 comes complete with all necessary hardware, and requires no electrical modification of the PET. The memory board derives its power from the PET transformer (but not from the PET regulators).

The 24K version of the PME-1 allows the writing of programs to the PET's total capacity. The 32K permits the storage of protected machine language programs and displays.

The board uses dynamic RAMs to maintain extremely low power dissipation and to permit internal installation. Under worst case conditions (when running the machine language memory test program), the 32K configuration requires less than 2.7 watts. All timing is referenced to signals available at the PET expansion memory connector and refresh is performed automatically and transparently, without slowing the CPU.



The cost of the PME-1 board has been reduced to $500 for the 16K board, $595 for the 24K, and $675 for the 32K. The board is covered by a six-month parts and labor warranty. For more information contact Computer Mart Systems, 13 East 30th St., New York, NY 10016. *Circle No. 172.*

Memory for the Heathkit H11 Computer

Designed for the Heathkit/Digital H 11 computer and the PDP 11/03 Microcomputer is Chrislin Industries' new CI 1103 memory module. The new memory features easy expansion from 8K to 32K by simple interchange of the 4027, 4K x 1 dynamic memory devices with their 16K equivalent with no further modification to the board. Available in 8, 16, 24, or 32K memory versions the unit plugs directly into the Heathkit/Digital H 11, LSI-11, PDP 11/03 or the LSI-11/2.

The CI 1103 is available with either on board distributed refresh or external refresh control logic. Data access time is 350 nsec and cycle time is 525 nsec. On board memory select is available in 2K increments up to 128K words of memory. Power consumption is under 7 watts. Size is 8.44" x 5.187". Single quantity price is $390 for 8K x 16 and $995 for 32K x 16. For more information, contact Chrislin Industries, Inc., Computer Products Division, 31312 Via Colinas #102, Westlake Village, CA 91361, (213) 991-2254. *Circle 163.*

32K PROM Board

Electronic Solutions Inc.'s 32K PROM Memory Board is compatible with Intel's SBC 80 Multibus. The PROM-32 accepts sixteen 2716 E-PROMs. All ICs including PROMs are socketed. Base addresses fall on 16K boundaries and are jumper selectable. Any number of 2K memory address blocks may be deselected by jumper removal. Memory access time is 475 ns max. The board uses 5 volts at .38 amp typ. and .72 amp max. fully loaded. The board costs $195 in unit quantity. For further information contact: Richard Van Antwerp, Electronic Solutions, Inc., 7969 Engineer Road, San Diego, CA 92111; (714) 292-0242. *Circle No. 201.*

RCA's Expansion Boards Add Color Capability and Music Synthesis

Two new expansion boards increase the capabilities of RCA's VIP personal computer to include color displays and music synthesis.

The VP-590 Color Board, which retails for $69, allows users to select one of three background colors for display; they then specify one of eight foreground colors for each of 64 screen areas. Any bit turned on in an area will be displayed in the foreground color, while 'off' bits in the area will display the background color. Both foreground and background colors can be changed at any time.

Software support for the VP-590 will be provided through CHIP-8C, a color graphics language which is upward compatible with the CHIP-8 language used on the present VIP. The VP-590 plugs directly into a socket provided on

both existing and future VIP units.

According to Richard Simpson, VIP product manager, "The low cost of the VIP Color Board is a result of using the new RCA CDP1862 color display IC circuit. The CDP1862 was specifically designed to interface with the CDP1861 circuit, which is used to generate the CIP's video graphics."

Another new expansion board allows its VIP personal computer to generate music. RCA also provides a computer program called PIN (Play It Now) to allow users to transcribe sheet music to play on the VIP, or compose their own music. This add-on allows users to generate a wide variety of sounds over a four-octave range. Because users have control over the tone envelope, they can simulate the sound of various conventional musical instruments, such as a clarinet, or create 'new instruments' with unusual sounds.

The VIP is a microcomputer based on the RCA COSMAC (CDP1802) microprocessor, and is designed to interface directly with a video monitor or through an external modulator onto a TV set. It is provided with an interpretive language to make it easy for users to write graphic games and other applications without learning machine language. The VIP contains a 16-key keypad for entering programs and has a built-in audio cassette interface to permit storing programs on a cassette recorder.

The VP-550 Super Sound Board will retail for $49. The board is completely assembled and will be sold through RCA industrial distributors and computer stores.

For further information, call Rick Simpson at (717) 291-5848, or write RCA COSMAC VIP Marketing, New Holland Avenue, Lancaster, PA 17604. *Circle No. 173.*

Memory Plus Expansion System for Kim-1

Memory Plus is a KIM-1-shaped and -sized board for extending KIM-1 capabilities. It contains 8K RAM (lower power 2102 static); provision for up to 8K EPROM (Intel type 2716 2K by 8-bit); a Versatile Interface Adapter with two 8-bit I/O ports, two timers, and a serial-to-parallel shift register (MOS

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CIRCLE 37

Technology 6522); and an on board EPROM Programmer. RAM and ROM are each addressable at any 8K (2K hex) boundary and may both be used simultaneously.

Other features are: on board regulators for +5V and +25V, EPROM Programming Program and Memory Test Program on cassette tape, socketed IC chips board fully assembled and tested. Memory Plus comes with connectors, mounting hardware, 60 page manual and schematics.

Options include: up to 4 Intel type 2K by 8-bit EPROMs to provide up to 8K EPROM ; one cable to go between the KIM-1 and Memory Plus expansion connectors; one cable to connect the Memory Plus application connector to your existing KIM-1 application connector; and a user's manual purchasable separately for $10, with cost credited toward purchase.

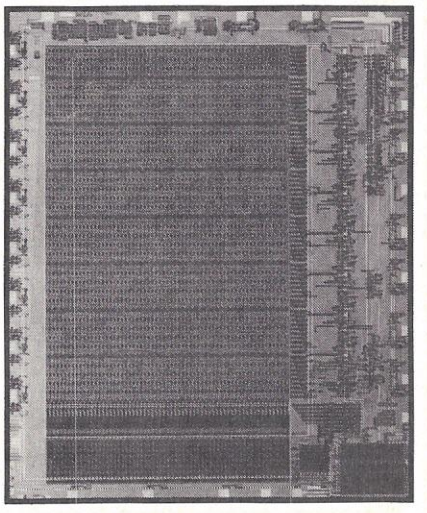
For more information contact the Computerlist, P.O. Box 3, S. Chelmsford, MA 01824. *Circle No. 160.*

Video Display Controller-Video Generator

CRT 8002 VDAC Video Display Controller-Video Generator, a MOS/LSI device that provides logic needed for character generation, video attribute and graphics, has been introduced by Standard Microsystems Corp. The device is a companion chip to SMC CRT 5027 VTAC Video Timing and Controller which provides the logic functions for generating all timing signals for presentation and formatting all video data in a CRT system. Together, the two chips comprise all the circuitry required for the display portion of a CRT video terminal.

CRT 8002 is an N-channel COPLAMOS MOS/LSI device which utilizes CLASP technology. It contains a 7 × 11 × 128 character generator ROM, a wide and thin graphics mode, external input mode, character address/data latch, field and/or character attribute logic, attribute latch, four cursor modes, two programmable blink rates, and a high speed video shift register.

The four cursor modes available on the CRT 8002 are underline, blinking underline, reverse video block, and blinking reverse video block. Any one of these can be mask programmed as the cursor function. There is a separate cursor blink rate which can be mask



programmed to provide a 15Hz to 1Hz blink rate.

CRT 8002 attributes include: reverse video, character blank,blink, underline, and strike-thru. The character blink rate is mask programmable from 7.5Hz to 0.5Hz and has a duty cycle of 75/25. The underline and strike-thru are similar but independently controlled functions and can be mask programmed to any number of raster lines at any position in the character block. These attributes are available in all modes.

The CRT 8002 video output may be connected directly to a CRT monitor video input. The CRT 5027 blanking output can be connected directly to the CRT 8002 retrace blank input to provide both horizontal and vertical retrace blanking of the video output. For further information contact Standard Microsystems Corp., 35 Marcus Boulevard, Hauppauge, NY 11787; (516) 273-3100. *Circle No. 170.*

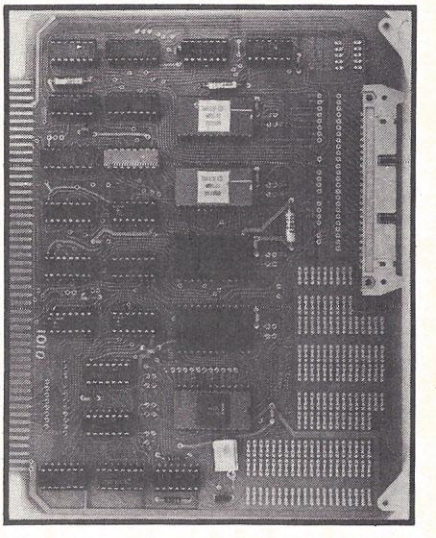
IEEE Interface

The P&T-488 interface board provides S-100 computers with an interface to the IEEE 488-1975 Standard Digital Interface for Programmable Instrumentation. Using the P&T-488, the computer can function as a talker, listener or controller on the interface bus, allowing intricate instrumentation systems to be configured with S-100 equipment supplying the intelligence. Software Package 1.0 is distributed with the P&T-488 on a machine readable cassette tape which can be read with the built in Bitwiggler tape interface and a standard audio cassette player. The software is supplied as source code in Intel standard mnemonics, allowing the user to locate the software in the memory region most suitable to his system. Cable assemblies are included to connect to the 488 bus and the cassette player. Unit price is $250 in kit form and $325 assembled and tested. OEM discounts available. For further information contact Pickles & Trout, PO Box 1026, Goleta, CA 93017. *Circle 162.*

Arithmetic Processor and Timer

The 8008 Arithmetic Processor, a general purpose arithmetic board that speeds complex math operations, is now available for GNAT microcomputer systems. Divide execution time for a 32 bit floating point number is 80 microsec, as compared to 5000 microsec for a software algorithm.

The 8008 Processor is designed to speed operations in real time process control, scientific computations and multiuser systems. With built-in add, subtract, multiply, divide, square root,



logarithm, exponential and trig functions in a 32-bit floating point format, the 8008 Processor brings to GNAT microcomputers the complex math capabilities of larger computer systems. The 8008 Arithmetic Processor can be expanded to use up to four

Am9511 devices. Each device is separately addressable for parallel processing or multiuser systems. In addition, the 8008 Processor is equipped with an 8253 programmable interval timer. With enhanced interrupt control for increased utility, it can ease multi-task functions and real time control problems.

The standard 8008 includes on Am9511 device and the interval timer. Price is $295 with delivery at stock to 30 days. For more information contact Frank Adams, GNAT Computers, Inc., 7895 Convoy Court, Unit 6, San Diego, CA 92111; (714) 560-0433. *Circle No. 176.*

International Data's New 88-SAI Bus

International Data Systems, Inc., announces the 88-SAI Synchronous/Asynchronous Interface for S-100 bus computers. Providing a synchronous or asynchronous port for any S-100 bus processor, the 88-SAI is intended for use in special communications requirements such as synchronous communications between S-100 computers and large scale computers, high speed MODEMs, data encryption devices, or other S-100 computers.

The 88-SAI allows baud rate, word size, parity, and number of stop bits to be selected completely under software control. Also under software control is synchronous/asynchronous communications such as number of sync characters.

Fully compatible with RS232C interfaces and non-standard devices requiring that various signal or handshake lines be inverted, the 88-SAI also provides interface to MIL-STD-188 level devices. To allow maximum flexibility, provision for use of non-mandatory control signals such as Signal Quality is included.

Manufactured from G10 epoxy glass, the 88-SAI measures 5" x 10" (not including edge connector). It requires four consecutive I/O addresses and the board address is selected by a DIP switch.

The 88-SAI is available in kit form for $199, or assembled, tested and with a limited warranty for $299. For more

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CIRCLE 38

What do you have in common with a plumbing contractor, an auto parts store owner and a real estate agent?

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So, mail your material to: Applications Editor, *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215, or call us at (617) 232-5470. We look forward to hearing from you.

information contact International Data Systems, Inc., 400 North Washington Street, Suite 200, Falls Church, VA 22046; (703) 536-7373. *Circle No. 159.*

Smart Cassette I/O Controller

Xecon's MS-CIO is a fully integrated audio cassette-serial I/O controller unit with a built in re-locatable operating system. This device supports two cassette/tape units and any data terminal/printer capable of communicating via either an RS-232 or 20 ma current loop interface.

The Smart cassette operating system handles motor control, file formatting, labeling, searching, and generation of inter-record gaps. To perform a cassette search, load, or dump the user simply "calls" the desired on-board operating routine.

The cassette interface may be operated at tape data rates of 1200, 2400 or 4800 bits/second. A reliable modified KC Standard (dual frequency FSK) modulation scheme is employed. Integral motor control drivers are provided. A special input pre-amplifier permits the unit to be used with any "hi-fi" recorder.

The serial I/O section provides for both RS-232 and 20 ma current loop data ports. All popular data rates are available. A Smart text editor operating system is also optionally available.

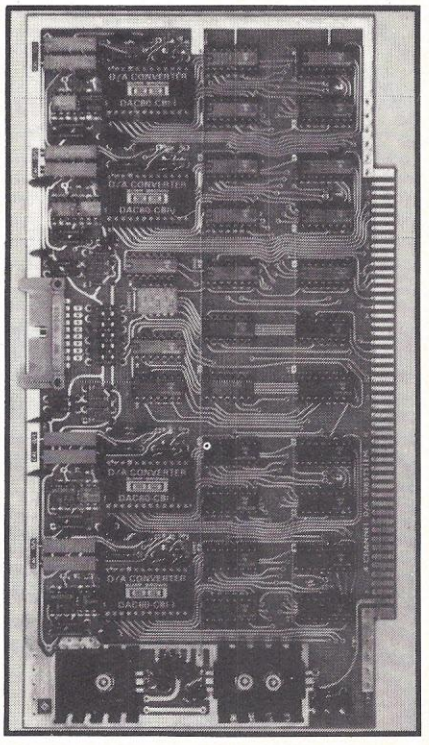
For user convenience, the on-board operating programs may be re-located to any position of the computers addressable memory.

The MS-CIO is supplied fully assembled and tested, complete with the Smart cassette/tape operating system for $205. For more information contact Xecon Micro, P.O. Box 267, Hawthorne, CA 90250. *Circle No. 168.*

4 Channel Converter

California Data Corporation has announced a four channel D/A converter for use with Z80 or 8080/8085 microprocessors. First in a series of S-100 Bus Compatible devices, CDC's D/A Board has 12 bit resolution and uses plug-in hybrid D/A converters with LSB accuracy. Power requirements are compatible with S-100 Bus voltages: +8 volts at 338 ma, +18 volts at 122 ma, and −18 volts at 156 ma.

CDC has incorporated selectable input and ouput configurations. Output is 10 volts F.S. or 20 volts F.S. (strap selectable). Output range may be plus or minus 5 volts, plus or minus 10 volts, 0 to +10 volts, or 0 to −10 volts. An inversion strap is also provided for decreasing output with increasing input. Output current is 10 ma. Independent gain and offset adjustments are provided.



Input coding may be either binary or two's complements. Conversion speed is 3 μ second typical with replaceable 74V op-amp output. Delivery is stock to 30 days. Price $495. For more information contact Jack A. Robinson, Marketing VP, California Data Corporation, 3475 Old Conejo Rd., Newbury Park, CA 91320; (805) 498-3651. *Circle No. 175.*

16K Static RAM

George Morrow, designer of the Econoram 4K static memory, has introduced a new 16K static memory board for S-100 microcomputer systems, SupeRam 16.

A complete kit featuring four independently addressable and write-protectable 4K blocks, SupeRam 16 uses just eleven ICs, keeping the board uncrowded and trouble-free. The board meets the proposed IEEE Standard for @-100, insuring compatibility with all S-100 systems. All signals are fully buffered, including address and data lines.

Costing $299, SupeRam 16K is available at computer retail outlets and may be ordered directly from Thinker Toys, 1201 10th St., Berkeley, CA 94710. For further information contact Neila Richmond, Thinker Toys, (415) 524-5317. *Circle No. 167.*

Dynamic RAM Boards from IMSAI

RAM III, a new line of dynamic random access memory boards developed by IMSAI Manufacturing Corporation, is available in 32K byte or 64K byte versions.

Designed for inclusion in IMSAI's line of VDP desk top computers, the boards are also available for add-on to existing systems. The 32K version retails at $895 and the 64K version retails at $1695. RAM III boards are S-100 bus compatible and do not make existing IMSAI RAM boards obsolete.

When selecting a dynamic random access memory board, major consideration is reliable data retention. With RAM III,refresh occurs during all stages of computer operation. During normal operation the refresh synchronizes to CPU timing so that refresh takes place when the CPU is not using memory. This "Hidden Refresh" requires no wait states. During operations that take place when the CPU is not running, such as Direct Memory Access (DMA), an internal timer generates refresh requests every 6.6 microseconds.

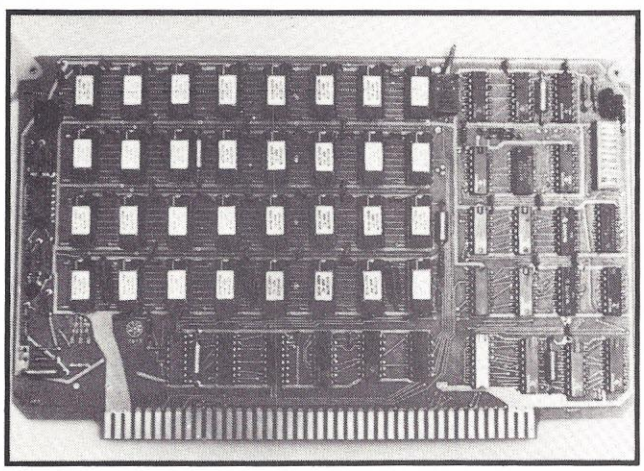
A high-precision delay line generates on-board timing for high performance and reliability. All RAM III boards have an access time of 375 nanoseconds and a cycle time of 500 nanoseconds.

For more information contact Walt Slater, IMSAI Manufacturing Corporation, 14860 Wicks Boulevard, San Leandro, CA 94577. (415) 483-2093. *Circle No. 165.*

RAM Memory Board for Motorola Exorcisor I or II

Chrislin Industries has announced the CI-6800 16K × 8 semiconductor memory system designed specifically for operation with Motorola EXORcisor, Motorola EXORcisor II and MEC 6800 evaluation modules. The new memory features easy expansion to 32K, 48K or 64K by interchanging the 4027, 4K by 1 dynamic memory chip with its 16K equivalent with no further modification to the board. CI-6800 memory board plugs directly into existing EXORcisor Connectors.

The CI-6800 allows maximum processor throughput with the use of hidden refresh control logic on board. Data access time is 300 nsec and cycle time is 750 nsec. On board



memory select is available in 4K increments up to 64K words of memory. Write disable switch on board makes the RAM a ROM to the outside world. Complete board power consumption is under 5 watts. Size is 5.75''. Single quantity price is $390 for 16K × 8 and $995 for 64K × 8.

For more information contact Chrislin Industries, Inc., Computer Products Division, 31312 Via Colinas #102, Westlake Village, CA 91361; (213) 991-2254. *Circle No. 171.*

Input/Output Controller

Technical Micro Systems has two products compatible with the Texas Instruments TM 990/100M. The TMS general purpose Input/Output (GPIO) is configured as 2-16 bit I/O Ports with data available flags, interrupts, resets and strobes. All lines are buffered with output buffers under CPU control. Other features include termination resistors, RS-232 serial port, baud rate dipswitch and port address dipswitches.

The TMS Floppy Disk Controller is IBM-compatible and double-sided. The FDC handles up to 4 drives, uses a phase-lock data separator and a switch selectable head load timer. The FDC also provides user definable I/O to the drive. The controller is compatible with TI diskette formats. Prices: (1-4) GPIO $395, FDC $795. For more information contact TMS, 17935 Sky Park Circle, Suite K, Irvine, CA 92714; (714) 549-3991. *Circle No. 177.*

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CIRCLE 2

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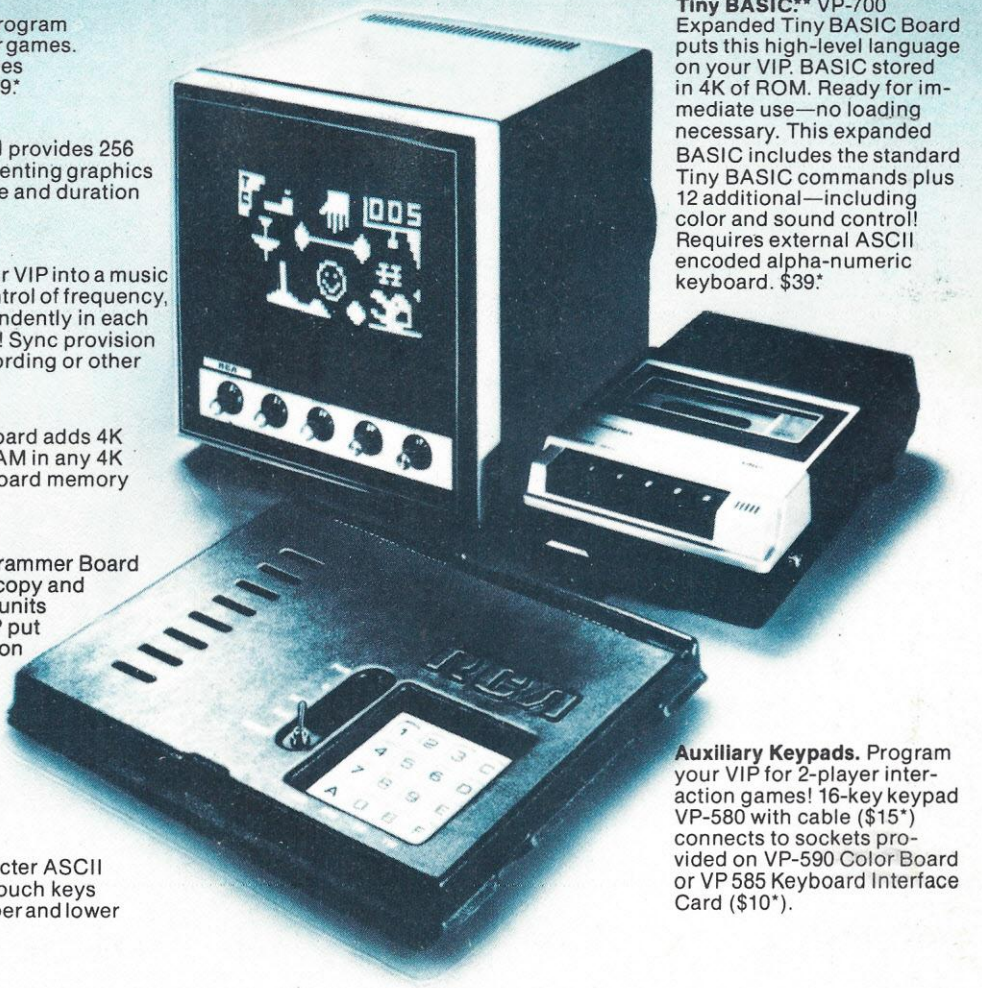

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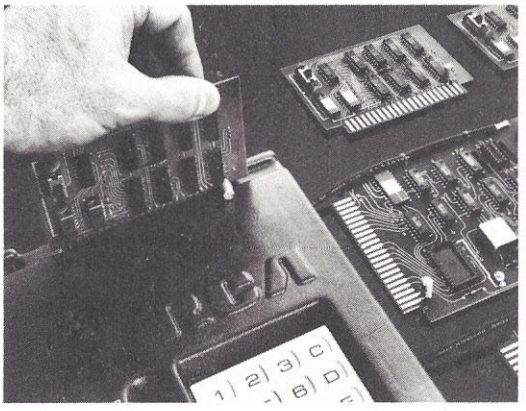

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